

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

7.14.2003

To:

ITO, TADAHICO
32nd Floor, Yebisu Garden Place
Tower, 20-3, Ebisu 4-chome
Shibuya-ku, Tokyo 150-6032
Japan

Date of mailing (day/month/year)

02 July 2003 (02.07.03)

Applicant's or agent's file reference

R03016 PCT

IMPORTANT NOTIFICATION

International application No.

PCT/JP03/05459

International filing date (day/month/year)

28 April 2003 (28.04.03)

International publication date (day/month/year)

Not yet published

Priority date (day/month/year)

30 April 2002 (30.04.02)

Applicant

RICOH COMPANY, LTD. et al

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority datePriority application No.Country or regional Office
or PCT receiving OfficeDate of receipt
of priority document

30 April 2002 (30.04.02)

2002-128682

JP

20 June 2003 (20.06.03)

From the INTERNATIONAL BUREAU

PCTNOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

ITOH, TADAHICO
32nd Floor, Yebisu Garden Place Tower, 20-3, Ebisu
4-chome
Shibuya-ku, Tokyo 150-6032
JAPON

Date of mailing (day/month/year)
05 November 2003 (05.11.03)

Applicant's or agent's file reference
R03016 PCT

IMPORTANT NOTICE

International application No.
PCT/JP03/05459

International filing date (day/month/year)
28 April 2003 (28.04.03)

Priority date (day/month/year)
30 April 2002 (30.04.02)

Applicant

RICOH COMPANY, LTD. et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this notice:

US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

EP

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this notice is a copy of the international application as published by the International Bureau on 13 November 2003 (13.11.03) under No. 03/094504

4. **TIME LIMITS** for filing a demand for international preliminary examination and for entry into the national phase

The applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be **30 MONTHS** from the priority date, not only in respect of any elected Office if a demand for international preliminary examination is filed before the expiration of **19 months** from the priority date, but also in respect of any designated Office, in the absence of filing of such demand, where Article 22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see *PCT Gazette* No. 44/2001 of 1 November 2001, pages 19926, 19932 and 19934, as well as the *PCT Newsletter*, October and November 2001 and February 2002 issues.

In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21, 30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at <http://www.wipo.int/pct/en/index.html>.

For filing a demand for international preliminary examination, see the *PCT Applicant's Guide*, Volume I/A, Chapter IX. Only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

It is the applicant's sole responsibility to monitor all these time limits.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

ITO, Tadahiko
32nd Floor, Yebisu Garden
Place Tower,
20-3, Ebis 4-chome,
Shibuya-ku, Tokyo 150-6032
JAPAN

WRITTEN OPINION

(PCT Rule 66)

Date of mailing
(day/month/year)

27.1.2004

Applicant's or agent's file reference

R03016 PCT

REPLY DUE

within 2 months from
the above date of mailing

International application No.

PCT/JP03/05459

International filing date (day/month/year)

28.04.03

Priority date (day/month/year)

30.04.02

International Patent Classification (IPC) or both national classification and IPC
Int.Cl⁷

H04N1/41, G10L11/00, H04N7/30, H03M7/30

Applicant

RICOH COMPANY, LTD.

1. This written opinion is the 5 (first, etc.) drawn by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is:

30.08.04

Name and mailing address of the IPEA/JP

Japan Patent Office

Authorized officer

Minoru MATSUNAGA

5V 4237

WRITTEN OPINION

International application No.

PCT/JP 03/05459

I. Basis of the opinion

1. With regard to the elements of the international application:*

☐ the international application as originally filed

☒ the description:
pages 1-21, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☒ the claims:
Nos. _____, as originally filed
Nos. _____, as amended (together with any statement) under Article 19
Nos. 1-18, filed with the demand
Nos. _____, filed with the letter of _____

☒ the drawings:
sheets/fig 1/15-15/15, as originally filed
sheets/fig _____, filed with the demand
sheets/fig _____, filed with the letter of _____

☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/fig _____

5. ☐ This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

WRITTEN OPINION

International application No.

PCT/JP 03/ 05459

IV. Lack of unity of invention

1. In response to the invitation (Form PCT/IPEA/405) to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
☐ paid additional fees.
☐ paid additional fees under protest.
☐ neither restricted nor paid additional fees.

2. This Authority found that the requirement of unity of invention is not complied with for the following reasons and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees:

The special technical features of claim 1-14 and 18 relates to image information processing while the special technical features of claim 15-17 relates to audio processing. There no technical relationship among those inventions involving one or more of the same or corresponding technical features. Therefore, these groups of inventions are not so linked as to form a single general inventive concept.

3. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this opinion:

- ☒ all parts.

WRITTEN OPINION

International application No.
PCT/JP 03/05459

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-18</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>2-4, 11</u>	YES
	Claims	<u>1, 5-10, 12-18</u>	NO
Industrial applicability (IA)	Claims	<u>1-18</u>	YES
	Claims		NO

2. Citations and explanations

D1: JP2000-188552 A(CANON INF SYST RES AUSTRALIA PTY LTD, CANON INC)
2000.07.04 & AU 005714799

D2: JP 8-298555 A(CANON INC) 1996.11.12

D3: EP 0869620 A2 (Samsung Electronics Co., Ltd.) 1998.10.07 & JP 10-285048 A
(The document D3 was not cited in the international search report.)

D4: JP2003-304405 A (RICOH CO LTD) 2003.10.03 (filed on 2002.04.10)
(The document D4 was not cited in the international search report.)

The subject matter of claim 1, 7-9, 10,12, 13, 14 and 18 does not involve an inventive step over D1 , D2 and commonly used art.

D1 (see claim 1 and 2) discloses "a method comprising the steps of encoding image information by a bit plane, generating an index parameter indexing degradation of image information caused by truncation of bit planes, compressing image information by truncating the bit planes which are determined based on the said index parameter."

D2(see claim 1) discloses a method attaching the attribute information which is stored in a comment marker to encoded image information.

JPEG2000 is a commonly used image processing method using encoding image information by a bit plane.

WRITTEN OPINION

International application No.

PCT/JP 03/ 05459

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: **v**

The subject matter of claim 5 and 6 does not involve an inventive step over D1 , D2 and common image processing method.

D1 (see claim 1 and 2) also discloses about "an amount of distortion of image information caused by the truncation" and "a slope parameter of distortion of image information caused by the truncation" as a parameter "block-rate".

The subject matter of claim 15-17 does not involve an inventive step over D1 , D2 and D3.

D3 (see claim 27 and 33) suggests that a digital processing method can apply to both audio and image signal.

D4(see claim 1 and 3) is a document of an earlier application relates to the subject matter of claim 2,3 and 11, which contains the steps of "counting a number of most significant bits of each bit plane of image information" and " predicting distortion of image information caused by the truncation of the bit planes based on number of most significant bits of each bit plane, wherein said index parameter contains the predicted distortion."

ATTENTION

Forms and Preparation Points for Documents to be Submitted

Forms for a written reply and a written amendment shall be prepared in conformity to Article 62 (Form 23) and Article 31 (Form 15) of Enforcement Regulations of Law Concerning the International Application of the Patent Cooperation Treaty and Related Matters.

[Remarks]

1. The paper sheet used is set to Row A, No. 4 (horizontal writing 21cm, 29.7cm) of the Japanese Industrial Standards; only one side of a flexible, strong, smooth, lusterless, and durable paper sheet with no fold is used with its shorter side at the top; and unnecessary characters, signs, frame lines, ruled lines, etc. shall not be written on this paper.
2. The paper shall be free of creases and tears.
3. Margins shall be set to at least 2cm at the upper edge, the right edge, and the bottom edge of the paper sheet, and 2.5cm at the left edge. In principle, the margins shall not exceed 4cm at the upper edge and the left edge, or 3cm at the right edge and the bottom edge. In these cases, the margins are left completely blank. The document number (provided it is described in the request) may be added in the margin corner of the upper edge and within 1.5cm of the upper edge.
4. The written reply shall be a typed or printed manuscript so that an arbitrary number of copies may be directly made by photograph, electrostatic method, photographic offset, or microfilm.
5. In all the paper sheets of the written reply, serial numbers starting from 1 in Arabic numerals shall be added in the center of the top or bottom edge of the paper sheet (except for the margin parts).
6. In cases of a typed manuscript, the space between the lines shall be set to at least 5mm. In case of using Roman letters in Remarks 11 and 14, the width shall be set to 1.5 letters.
7. Items mentioned shall be written in characters of No. 4 type (Roman letters used for Remarks 11 and 14 are set to not less than 0.21cm in height in capital letters), wherein the color used shall be dark and non-fading, and the characters shall fulfill the requirements prescribed in Remark 4.
8. In the column "Indication of International Application," where an applicant has already received the notification of the international application number from the Patent Office, the number shall be described in such a manner as "PCT/JP00/000000," where the applicant has not yet received the notification of the international application number, the date of submitting the international application shall be described in the order of date, month and year in such a manner as "international application submitted on 00.00.00" (as for the year, only the last two figures of the Christian Era shall be described), and the document number (provided it is described in the request) shall be also described therein.
9. The "Name of Applicant" shall be described as the full name in the order of family name and first name in the case of an individual person; in the case of a juridical body, the name shall be described.
10. The "Address" shall be described in detail such as "Japan, prefecture, county, village, major article, minor article, plot number, and house number" and the postal code shall be also stated.
11. The transliteration of the name and the address of the applicant or their translation into English shall be also added thereto using Roman letters.
12. In the column "Nationality," the name of the country of the applicant or the representative shall be described.
13. In the column "Address," the name of the country in which the applicant or the representative resides shall be described.
14. In the case of describing the name of a country, the name of the country designated by the Commissioner shall be written in Japanese and English.
15. In the column "Representative," the name of the representative shall be described and the applicable one from among "lawyer," "patent attorney," and "legal representative" shall be described before the name of the representative.
16. Where a representative is stated, the seal of the applicant is not necessary; if there is no representative, the column "Representative" need not be provided.
17. In each paper sheet, erasure, correction, overwriting, and inserted lines are not permitted in principle.
18. The paper sheets for the written reply shall be filed with, for example, a clip so as to be easily separated or re-filed.
19. In the "Address," only one address of each applicant, representative, attorney, or sub-attorney shall be described.
20. In the column "Sub-Attorney," the name of the sub-attorney shall be described and the applicable name from among "lawyer" or "patent attorney" shall be described before the name of the sub-attorney.
21. Where a sub-attorney is stated, the seal of an attorney is not necessary; if

- there is no sub-attorney, the column "Sub-attorney" need not be provided.
22. The Christian Era or Gregorian Calendar shall be used for the date. Figures of the day, figures of the month, and last two figures of the year shall be expressed in Arabic numerals respectively in this order, and a period shall be added after the figures of the day and the month (for example, March 30th, 1978 shall be written as "30.03.78"). When using another era or calendar, the Christian Era or Gregorian Calendar shall be added thereto.

Form 23 (Related to Article 62)

REPLY(ARGUMENT)

To: Examiner of the Patent Office

1. Identification of the International Application

2. Applicant (Common Representative)

Name: seal

Address:

Country of Nationality:

Country of residence:

3. Agent

Name: seal

Address

4. Date of Notification

5. Subject Matter of Reply(Argument)

6. List of Attached Documents

[Remarks]

1. In case an amendment is made pursuant to the order in the provisions of Article 6 of the Patent Law, the title shall be set to "AMENDMENT (amendment based upon the order in the provisions of Article 6 of said Law)"; in case an amendment is made pursuant to the provisions of Article 11 of said Law, the title shall be set to "AMENDMENT (amendment based upon the provisions of Article 11 of said Law)"; in case an amendment is made pursuant to the order in the provisions of Item 2 of Article 1 of the Patent Law Enforcement Order, the title shall be set to "AMENDMENT (amendment based upon the order in the provisions of Item 2 of Article 1 of said Order)"; in case an amendment is made pursuant to the provisions of Item 1 of Article 27-3, the title shall be set to "AMENDMENT (amendment based upon the provisions of Item 1 of Article 27-3)"; in case an amendment is made pursuant to the order in the provisions of Item 1 of Article 28, the title shall be set to "AMENDMENT (amendment based upon the order in the provisions of Item 1 of Article 28)"; in case a flexible disk is submitted pursuant to the provisions of Item 3 of Article 50-3, the title shall be set to "SUBMISSION OF FLEXIBLE DISK Based Upon the Provisions of Item 3 of Article 50-3"; in case a flexible disk is submitted pursuant to the order in the provisions of Item 5 of Article 50-3, the title shall be set to "SUBMISSION OF FLEXIBLE DISK Based upon the Order in the Provisions of Item 3 of Article 50-3"; in case a document describing the sequence listing is submitted pursuant to the order in the provisions of Item 5 of Article 50-3, the title shall be set to "SUBMISSION OF DOCUMENT DESCRIBING SEQUENCE LISTING Based upon the Order in the Provisions of Item 5 of Article 50-3"; and in case an amendment is made pursuant to the order in the provisions of Item 8 of Article 50-3, the title shall be set to "AMENDMENT (amendment based upon the order in the provisions of Item 8 of Article 50-3)".
2. If an examiner of the Patent Office has given an opportunity for submitting a written reply or its amendment, the reply or the amendment shall be submitted to said examiner of the Patent Office, and it shall be submitted to the Commissioner of the Patent Office for any other cases.
3. In the column "Object of Amendment," the name of the document to be amended and the passage to be amended shall be described in such a manner as "Request II, Column of Applicant."
4. In the column "Contents of Amendment," "as per an accompanying sheet" shall be described and the matters to be amended shall be pointed out, and a replacement paper sheet for the amendment shall be appended. However, where the whole of the paper sheet is deleted as a result of the amendment, where the amendment is made pursuant to the order in the provisions of Article 6 of the Patent Law, Item 2 of Article 1 of the Patent Law Enforcement Order, Item 1 of Article 28 or Item 8 of Article 50-33, or where the amendment is made pursuant to the provisions of Item 1 of Article 27-3, there is no need to use a replacement paper sheet if the matters related to the amendment can be easily re-written in the original text. Where a replacement paper sheet for an amendment provided for in Article 11 of the Patent Law is appended, and the matter related to the amendment is a deletion or an addition of only a part of a passage or a minor correction, the amendment may be made in the copy of the written amendment that has been submitted before instead of using a replacement paper sheet provided it does not affect the neatness and direct copying of the paper sheet.
5. When the scope of claims is amended, a replacement paper sheet

[Continued]

describing the scope of claims related to said amendment as follows shall be appended.

- a) When a new item is added to the scope of claims, the number given to the last item of the scope of claims before being amended shall be described before the item to be added in such a manner as "○ (added)."
- b) When any item of the scope of claims is deleted, the number given to the item of the scope of claims to be deleted shall be described in such a manner as "○ (deleted)."
- c) When the scope of claims is amended without increasing or decreasing the number of items of the scope of claims, the same number as that for the item of the scope of claims before being amended shall be given to the amended item of the scope of claims in such a manner as "○ after being amended."

6. When a flexible disk is submitted pursuant to the provisions of Item 3 of Article 30-3 or when a flexible disk is submitted pursuant to the order in the provisions of Item 5 of Article 60-3, descriptions shall be made as follows.

- a) In the column "7. List of Attached Documents," the following items shall be described.

5. List of Attached Documents

- (1) Flexible disk that records code data concerning sequence listing: 1 piece
- (2) Statement: 1 copy
- (3) Document describing information about the recording method, etc. of a flexible disk: 1 copy

- b) In principle, the "Statement" shall be prepared pursuant to the sample shown below. The item "Indication of International Application" shall be described pursuant to Remark 15 described hereunder.

(Sample)

STATEMENT

To: the Commissioner of the Patent Office

I hereby declare that the base sequence and amino acid sequence recorded in the flexible disk attached to this document have faithfully encoded the base sequence and amino acid sequence described in the specification without making any change of the contents.

Day month, year

Indication of International Application

Title of the Invention

Applicant or Agent

- c) "Document describing information about the recording method, etc. of a flexible disk" shall be made, in principle, by providing and describing such items as "Name of Applicant," "Name of Agent," "Indication of International Application," "Title of the Invention," "Character Code Used," "Name of a File Recording the Sequence," and "Person to be Contacted (phone number and name of the person in charge)."

- d) Columns "5. Object of Amendment" and "6. Contents of Amendment" shall not be provided.

When a document describing the sequence listing pursuant to the order in the provisions of Item 5 of Article 60-3, the following item shall be described in the column "7. List of Attached Documents," and columns "5. Object of Amendment" and "6. Contents of Amendment" shall not be provided.

5. List of Attached Documents

- (1) Document describing the sequence listing: 1 copy

8. The paper sheet used is set to Row A, No. 4 (horizontal writing 21cm, 29.7cm) of the Japanese Industrial Standards; only one side of a flexible, strong, smooth, lusterless, and durable paper sheet with no fold is used with its shorter side at the top; and unnecessary characters, signs, frame lines, ruled lines, etc. shall not be written on this paper.
9. The paper shall be free of creases and tears.
10. Margins shall be set to at least 2cm at the upper edge, the right edge, and the bottom edge of the paper sheet, and 2.5cm at the left edge. In principle, the margins shall not exceed 4cm at the upper edge and the left edge, or 3cm at the right edge and the bottom edge. In these cases, the margins are left completely blank. The document number (provided it is described in the request) may be added in the margin corner of the upper edge and within 1.5cm of the upper edge.
11. The written amendment shall be a typed or printed manuscript so that an arbitrary number of copies may be directly made by photograph, electrostatic method, photographic offset, or microfilm.
12. In all the paper sheets of the written amendment, serial numbers starting from 1 in Arabic numerals shall be added in the center of the top or bottom edge of the paper sheet (except for the margin parts).
13. In cases of a typed manuscript, the space between the lines shall be set to

at least 5mm. In case of using Roman letters in Remarks 11 and 14, the width shall be set to 1.5 letters.

14. Items mentioned shall be written in characters of No. 4 type (Roman letters used for Remarks 11 and 14 are set to not less than 0.21cm in height in capital letters), wherein the color used shall be dark and non-fading, and the characters shall fulfill the requirements prescribed in Remark 9.
15. In the column "Indication of International Application," where an applicant has already received the notification of the international application number from the Patent Office, the number shall be described in such a manner as "PCT/JPO○○/○○○○○," where the applicant has not yet received the notification of the international application number, the date of submitting the international application shall be described in the order of date, month and year in such a manner as "international application submitted on ○○.○○.○○" (as for the year, only the last two figures of the Christian Era shall be described), and the document number (provided it is described in the request) shall be also described therein.
16. The "Name of Applicant" shall be described as the full name in the order of family name and first name in the case of an individual person; in the case of a juridical body, the name shall be described.
17. The "Address" shall be described in detail such as "Japan, prefecture, county, village, major article, minor article, plot number, and house number" and the postal code shall be also stated.
18. The transliteration of the name and the address of the applicant or their translation into English shall be also added thereto using Roman letters.
19. In the column "Nationality," the name of the country of the applicant or the representative shall be described.
20. In the column "Address," the name of the country of the applicant or the representative shall be described.
21. In the case of describing the name of a country, the name of the country designated by the Commissioner shall be written in Japanese and English.
22. In the column "Representative," the name of the representative shall be described and the applicable one from among "lawyer," "patent attorney," and "legal representative" shall be described before the name of the representative.
23. Where a representative is stated, the seal of the applicant is not necessary; if there is no representative, the column "Representative" need not be provided.
24. In each paper sheet, erasure, correction, overwriting, and inserted lines are not permitted in principle.
25. The paper sheets for the written reply shall be filed with, for example, a clip so as to be easily separated or re-filed.
26. In the "Address," only one address of each applicant, representative, attorney, or sub-attorney shall be described.
27. In the column "Sub-Attorney," the name of the sub-attorney shall be described and the applicable name from among "lawyer" or "patent attorney" shall be described before the name of the sub-attorney.
28. Where a sub-attorney is stated, the seal of an attorney is not necessary; if there is no sub-attorney, the column "Sub-attorney" need not be provided.
29. The Christian Era or Gregorian Calendar shall be used for the date. Figures of the day, figures of the month, and last two figures of the year shall be expressed in Arabic numerals respectively in this order, and a period shall be added after the figures of the day and the month (for example, March 30th, 1978 shall be written as "30.03.78"). When using another era or calendar, the Christian Era or Gregorian Calendar shall be added thereto.

Form 15 (Related to Article 31)

CORRECTION(AMENDMENT)

To: Commissioner of the Patent Office

(To : Examiner of the Patent Office)

1. Identification of International Application

2. Applicant (Common Representative)

Name: _____ Signature _____ (Seal)

Address:

Country of nationality:

Country of residence:

3. Agent

Name: _____ Signature _____ (Seal)

Address:

4. Date of Invitation

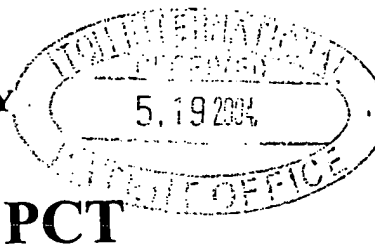
5. Item to be Corrected(Amended)

6. Subject Matter of Correction(Amendment)

7. List of Attached Documents

BEST AVAILABLE COPY

PATENT COOPERATION TREATY



From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
ITO, Tadahiko
32nd Floor, Yebisu Garden
Place Tower,
20-3, Ebis 4-chome,
Shibuya-ku, Tokyo 150-6032
JAPAN

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing (day/month/year)		18. 5. 2004
Applicant's or agent's file reference R03016 PCT		IMPORTANT NOTIFICATION
International application No. PCT/JP 03/05459	International filing date (day/month/year) 28.04.2003	Priority date (day/month/year) 30.04.2002
Applicant RICOH COMPANY, LTD.		

- The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
- A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
- Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
- REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/JP Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Commissioner of the Patent Office Telephone No. +81-3-3581-1101 Ext. 3571	5V 4237
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BEST AVAILABLE COPY

ATTENTIONS

1. Demand for copy of documents

Copy of the documents described in the international preliminary examination report and not described in the international search report.

An applicant can request the copy of these cited documents to the Japan Patent Office, however, Japan Patent Information Organization also services sales of the copy of these cited documents. Those who request copying of the cited documents should pay attention to the following points.

[Application Method]

- (1) As for Patent (Utility Model, Design) Gazette, the following points shall be defined clearly.

Types of patent, utility model, and design

Fiscal year and number of publication of application or publication of unexamined application (or patent number, registration number)

Necessary number of paper sheets

- (2) As for documents except for the gazette, the following points are required attention.

Be sure to attach the copy of the international preliminary examination report (which shall be returned).

[Application and Reference]

〒135-0016

4-1-7 Toyo Koto-ku, Tokyo

Sato Daiya Building

Foundation of Japan Patent Information Organization

Information Processing Department

Copy Service section

TEL: 03-3508-2313

Note) The period for requesting the copy of the documents to Japanese Patent Office is set to 7 years from the international application date.

2. It is necessary to submit the copy of international application (except for cases of already transmitted from the International Bureau) and its prescribed translation, and to pay the national fee. Respective countries set different periods so as to be required attention. (See Treaty Article 22, Article 39, and Article 64 (2) (a) (i))

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:
IPEA/ JP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only			
Identification of IPEA		Date of receipt of DEMAND	
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference R03016 PCT	
International application No. PCT/JP03/05459	International filing date (day/month/year) 28.04.03	(Earliest) Priority date (day/month/year) 30.04.02	
Title of invention METHOD OF PROCESSING IMAGE AND AUDIO INFORMATION, IMAGE AND AUDIO PROCESSING APPARATUS AND COMPUTER PROGRAM THAT CAUSES A COMPUTER TO PROCESS IMAGE AND AUDIO INFORMATION			
Box No. II APPLICANT(S)			
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) RICOH COMPANY, LTD. 3-6, Nakamagome 1-chome, Ohta-ku, Tokyo 143-8555 Japan		Telephone No. 03-3777-8111	
		Facsimile No. 03-5742-5429	
		Teleprinter No.	
		Applicant's registration No. with the Office	
State (that is, country) of nationality: Japan		State (that is, country) of residence: Japan	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) KADOWAKI, Yukio 242-6, Horencho, Nara-shi, Nara 630-8113 Japan			
State (that is, country) of nationality: Japan		State (that is, country) of residence: Japan	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)			
State (that is, country) of nationality:		State (that is, country) of residence:	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.			

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: (Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)

ITOH, Tadahiko
 32nd Floor, Yebisu Garden Place Tower,
 20-3, Ebisu 4-chome, Shibuya-ku, Tokyo 150-6032 Japan

Telephone No.

03-5424-2511

Facsimile No.

03-5424-2525

Teleprinter No.

Agent's registration No. with the Office

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as originally filedthe description ☒ as originally filed☐ as amended under Article 34the claims ☐ as originally filed☒ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☒ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (This check-box may be marked only where the time limit under Article 19 has not yet expired.)

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English.....

☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT)

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|----------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | 9 sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | 1 sheets |
| 6. other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received	not received
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|--|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 5. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> original separate power of attorney | 6. <input type="checkbox"/> sequence listing in computer readable form |
| 3. <input type="checkbox"/> original general power of attorney | 7. <input checked="" type="checkbox"/> other (specify): revenue stamps of IP fee, certificate of payment |
| 4. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

ITOH, Tadahiko



For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. PCT/JP03/05459	For International Preliminary Examining Authority use only	
Applicant's or agent's file reference R03016 PCT	Date stamp of the IPEA	
Applicant		
CALCULATION OF PRESCRIBED FEES		
1. Preliminary examination fee	28,000	<input type="checkbox"/> P
2. Handling fee (<i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i>)	19,200	<input type="checkbox"/> H
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	47,200	
TOTAL		
MODE OF PAYMENT		
<input type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash	
<input type="checkbox"/> cheque	<input checked="" type="checkbox"/> revenue stamps	
<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons	
<input checked="" type="checkbox"/> bank draft	<input type="checkbox"/> other (specify):	
AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT <i>(This mode of payment may not be available at all IPEAs)</i>		
<input type="checkbox"/> Authorization to charge the total fees indicated above.	IPEA/ _____	
<input type="checkbox"/> <i>(This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)</i> Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.	Deposit Account No.: _____	
	Date: _____	
	Name: _____	
	Signature: _____	

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 21 MAY 2004

WPS

PCT

Applicant's or agent's file reference R03016 PCT	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/JP 03/05459	International filing date (day/month/year) 28.04.2003	Priority date (day/month/year) 30.04.2002
International Patent Classification (IPC) or national classification and IPC Int.Cl. H04N1/41, G10L11/00, H04N7/30, H03M7/30		
Applicant RICOH COMPANY, LTD.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 08.08.2003	Date of completion of this report 26.04.2004	
Name and mailing address of the IPEA/JP Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Minoru MATSUNAGA	5V 4237
Telephone No. +81-3-3581-1101 Ext. 3571		

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/JP 03/05459

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
pages 1-21 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____
- ☒ the claims:
Nos. _____ , as originally filed
Nos. 1-18 , as amended (together with any statement) under Article 19
Nos. _____ , filed with the demand
Nos. _____ , filed with the letter of _____
- ☒ the drawings:
sheets/figs 1/15-15/15 , as originally filed
sheets/figs _____ , filed with the demand
sheets/figs _____ , filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
☐ paid additional fees.
☐ paid additional fees under protest.
☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
☒ not complied with for the following reasons:

The special technical features of claim 1-14 and 18 relates to image information processing while the special technical features of claim 15-17 relates to audio processing. There no technical relationship among those inventions involving one or more of the same or corresponding technical features. Therefore, these groups of inventions are not so linked as to form a single general inventive concept.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
☐ the parts relating to claims Nos.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/JP 03 / 05459

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-18</u>	YES
	Claims	<u></u>	NO
Inventive step (IS)	Claims	<u>2-4, 11</u>	YES
	Claims	<u>1, 5-10, 12-18</u>	NO
Industrial applicability (IA)	Claims	<u>1-18</u>	YES
	Claims	<u></u>	NO

2. Citations and explanations (Rule 70.7)

D1: JP2000-188552 A(CANON INF SYST RES AUSTRALIA PTY LTD, CANON INC)
2000.07.04 & AU 005714799

D2: JP 8-298555 A(CANON INC) 1996.11.12

D3: EP 0869620 A2 (Samsung Electronics Co., Ltd.) 1998.10.07 & JP 10-285048 A
(The document D3 was not cited in the international search report.)

D4: JP2003-304405 A (RICOH CO LTD) 2003.10.03 (filed on 2002.04.10)
(The document D4 was not cited in the international search report.)

The subject matter of claim 1, 7-9, 10, 12, 13, 14 and 18 does not involve an inventive step over D1, D2 and commonly used art.

D1 (see claim 1 and 2) discloses "a method comprising the steps of encoding image information by a bit plane, generating an index parameter indexing degradation of image information caused by truncation of bit planes, compressing image information by truncating the bit planes which are determined based on the said index parameter."

D2(see claim 1) discloses a method attaching the attribute information which is stored in a comment marker to encoded image information.

JPEG2000 is a commonly used image processing method using encoding image information by a bit plane.

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: **V**

The subject matter of claim 5 and 6 does not involve an inventive step over D1 , D2 and common image processing method.

D1 (see claim 1 and 2) also discloses about "an amount of distortion of image information caused by the truncation" and "a slope parameter of distortion of image information caused by the truncation" as a parameter "block-rate".

The subject matter of claim 15-17 does not involve an inventive step over D1 , D2 and D3.

D3 (see claim 27 and 33) suggests that a digital processing method can apply to both audio and image signal.

D4(see claim 1 and 3) is a document of an earlier application relates to the subject matter of claim 2,3 and 11, which contains the steps of "counting a number of most significant bits of each bit plane of image information" and " predicting distortion of image information caused by the truncation of the bit planes based on number of most significant bits of each bit plane, wherein said index parameter contains the predicted distortion."

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CLAIMS

1. (Amended) A method of processing image information, comprising the steps of:

5 encoding said image information by a bit plane;
 generating an index parameter indexing degradation
of said image information caused by truncation of one or more
bit planes based on said image information;

 compressing said image information by truncating
10 the bit planes; and

 attaching said index parameter to the encoded image
information;

 wherein the bit planes to be truncated are
determined based on the attached index parameter.

15

2. (Amended) A method of processing image information, comprising the steps of:

 encoding said image information by a bit plane;
 generating an index parameter indexing degradation
20 of said image information caused by truncation of one or more
bit planes based on said image information;

 compressing said image information by truncating
the bit planes determined based on said index parameter; and

 counting a number of most significant bits of each
25 bit plane of said image information before encoding;

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wherein said index parameter is said number of most significant bits of each bit plane.

5 3. (Amended) The method as claimed in claim 2,
further comprising the step of predicting distortion of said
image information caused by the truncation of the bit planes
based on said number of most significant bits of each bit
plane, wherein said index parameter contains the predicted
10 distortion.

 4. (Amended) The method as claimed in claim 3,
further comprising the step of predicting a slope parameter of
said distortion of said image information caused by the
15 truncation of the bit planes based on said number of most
significant bits of each bit plane, wherein said index
parameter contains the predicted distortion and the predicted
slope parameter.

20 5. (Amended) The method as claimed in claim 1,
further comprising the step of obtaining an amount of
distortion of said image information caused by the truncation
of the bit planes based on said image information before
encoding, wherein said index parameter contains the obtained
25 amount of distortion.

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6. (Amended) The method as claimed in claim 5,
further comprising the step of obtaining a slope parameter of
said distortion of said image information caused by the
5 truncation of the bit planes based on said image information
before encoding, wherein said index parameter contains the
obtained amount of distortion and the obtained slope parameter.

7. (Amended) The method as claimed in claim 1,
10 wherein said image information is compressed with JPEG 2000.

8. (Amended) The method as claimed in claim 1,
wherein said image information is compressed with JPEG 2000;
and the generated index parameter is stored in a comment
15 marker of the encoded image information.

9. (Amended) The method as claimed in claim 8,
wherein said comment marker is provided in a main header or a
tile part header of the encoded image information.

20

10. (Amended) An image processing apparatus,
comprising:

an encoding unit that encodes image information by
a bit plane;

25 an index generating unit that generates index

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parameter indexing degradation of said image information
caused by truncation of one or more bit planes based on said
image information;

5 a compressing unit that compresses said image
information by truncating the bit planes; and
 an index attaching unit that attaches said index
parameter to the encoded image information;

 wherein the bit planes to be truncated are
10 determined based on the attached index parameter.

11. (Amended) An image processing apparatus,
comprising:

 an encoding unit that encodes image information by
15 a bit plane;

 an index generating unit that generates index
parameter indexing degradation of said image information
caused by truncation of one or more bit planes based on said
image information;

20 a compressing unit that compresses said image
information by truncating the bit planes determined based on
said index parameter; and

 a counting unit that counts a number of most
significant bits of each bit plane of said image information
25 before encoding;

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wherein said index parameter contains said number of most significant bits of each bit plane.

5 12. (Amended) A method of processing image information, comprising the steps of:

 encoding said image information by a portion;

 generating index parameter indexing degradation of said image information caused by deletion of one or more

10 portions of said image information;

 compressing said image information by deleting the portions; and

 attaching said index parameter to the encoded image information;

15 wherein the portions to be deleted are determined based on said index parameter.

 13. (Amended) An image processing apparatus, comprising:

20 an encoding unit that encodes image information by a portion;

 an index generating unit that generates index parameter indexing degradation of said image information caused by deletion of one or more portions of said image

25 information;

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a compressing unit that compresses said image information by deleting the portions; and

an index attaching unit that attaches said index parameter to the encoded image information;

wherein the portions to be deleted are determined based on said index parameter.

14. (Amended) A computer program that causes a computer to process image information, comprising the steps of:

encoding said image information by a bit plane;

generating index parameter indexing degradation of said image information caused by truncation of one or more bit planes based on said image information;

compressing said image information by truncating the bit planes; and

attaching said index parameter to the encoded image information;

wherein the bit planes to be truncated are determined based on the attached index parameter.

15. (Amended) A method of processing audio information, comprising the steps of:

encoding said audio information by a portion;

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generating index parameter indexing degradation of
said audio information caused by deletion of one or more
portions of said audio information;

5 compressing said audio information by deleting the
portions; and

attaching said index parameter to the encoded audio
information;

10 wherein the portions to be deleted are determined
based on said index parameter.

16. (Amended) An audio processing apparatus,
comprising:

15 an encoding unit that encodes audio information by
a portion;

an index generating unit that generates index
parameter indexing degradation of said audio information
caused by deletion of one or more portions of said audio
information;

20 a compressing unit that compresses said audio
information by deleting the portions; and

an index attaching unit that attaches said index
parameter to the encoded audio information;

25 wherein the portions to be deleted are determined
based on said index parameter.

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17. (Amended) A computer program that causes a computer to process audio information, comprising the steps of:

- 5 encoding said audio information by a portion;
 generating index parameter indexing degradation of
said audio information caused by deletion of one or more
portions of said audio information;
 compressing said audio information by deleting the
10 portions;
 attaching said index parameter to the encoded audio
information; and
 wherein the portions to be deleted are determined
based on said index parameter.

15

18. (Amended) A computer program that causes a computer to process image information, comprising the steps of:

- 20 encoding said image information by a portion;
 generating index parameter indexing degradation of
said image information caused by deletion of one or more
portions of said image information;
 compressing said image information by deleting the
portions; and
25 attaching said index parameter to the encoded image

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information;

wherein the portions to be deleted are determined
based on said index parameter.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

ITO, Tadahiko
32nd Floor, Yebisu Garden
Place Tower,
20-3, Ebisu 4-chome,
Shibuya-ku, Tokyo 150-6032
Japan

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference R03016 PCT	Date of mailing (day/month/year) 03.06.03
International application No. PCT/JP03/05459	International filing date (day/month/year) 28.04.03
Applicant RICOH COMPANY, LTD.	

1. ☒ The applicant is hereby notified that the international search report has been established and is transmitted herewith.
Filing of amendments and statement under Article 19:
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.
3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/JP Japan Patent Office	Authorized officer Commissioner of the Patent Office	5V 4237
--	--	----------------

ATTENTIONS

1. An applicant should pay attention that there is an amendment period for requesting to International Bureau computing from the dispatch date of the international search report under Treaty Article 19 (1) and Regulations 46.1.
2. An applicant should pay attention to the period prescribed by Treaty Article 22 (2).
3. Demand for copy of documents

Copy of the documents described in the international search report.

An applicant can request the copy of these cited documents to the Japanese Patent Office, however, Japan Patent Information Organization also services sales of the copy of these cited documents. Those who request copying of the cited documents should pay attention to the following points.

[Application Method]

- (1) As for Patent (Utility Model, Design) Gazette, the following points shall be defined clearly.
 - ☐ Types of patent, utility model, and design
 - ☐ Fiscal year and number of publication of application or publication of unexamined application (or patent number, registration number)
 - ☐ Necessary number of paper sheets
- (2) As for documents except for the gazette, the following points are required attention.
 - ☐ Be sure to attach the copy of the international search report (which shall be returned).

[Application and Reference]

〒135-0016

4-1-7 Toyo Koto-ku, Tokyo
Sato Daiya Building
Foundation of Japan Patent Information Organization
Information Processing Department
Copy Service section
TEL: 03-3508-2313

Note: The period for requesting the copy of the documents to Japan Patent Office is set to 7 years from the international application date.

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under Article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article," "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended ?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Preliminary Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When ? Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments ?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How ? Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments ?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under Article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/IPEA/401).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see the *PCT Applicant's Guide*, Volume II.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference R03016 PCT	<div style="display: flex; justify-content: space-between;"> <div> FOR FURTHER ACTION </div> <div> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. </div> </div>	
International application No. PCT/JP 03/05459	International filing date (day/month/year) 28.04.03	(Earliest) Priority Date (day/month/year) 30.04.02
Applicant <div style="text-align: center; padding-top: 10px;"> RICOH COMPANY, LTD. </div>		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (See Box II).

4. With regard to the title,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

METHOD OF PROCESSING IMAGE AND AUDIO INFORMATION, IMAGE AND AUDIO PROCESSING APPARATUS AND COMPUTER PROGRAM THAT CAUSES A COMPUTER TO PROCESS IMAGE AND AUDIO INFORMATION

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 14

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/05459

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl⁷ H04N1/41, G10L11/00, H04N7/30, H03M7/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl⁷ H04N1/41, G10L11/00, H04N7/30, H03M7/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 Japanese Utility Model Gazette 1926-1996, Japanese Publication of Unexamined Utility Model Applications 1971-2001, Japanese Registered Utility Model Gazette 1994-2001, Japanese Gazette Containing the Utility Model 1996-2001

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2001-320588 A (CANON INC) 2001.11.16 & <u>US 2001/0021223 A1</u> , & EP 1 134 968 A2 CLAIM 1, 4	1, 2, 6, 8, 11, 12, 14-20 3-5, 7, 9, 10, 13
X A	JP 2000-188552 A (CANON INF SYST RES AUSTRALIA PTY LTD, CANON INC) 2000.07.04 & AU 005714799 CLAIM 1, 2, 6	1, 6, 7, 11, 14-20 2-5, 8-10, 13
X A	JP 6-225153 A (FUJI XEROX CO LTD) 1994.08.12 & <u>US 005631977 A1</u> CLAIM 1, 3	1, 6, 11, 14-2 0 2-5, 7-10, 12 , 13



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

21.05.03

Date of mailing of the international search report

03.06.03

Name and mailing address of the ISA/JP

Japan Patent Office

3-4-3 Kasumigaoka Chiyoda-ku, Tokyo 100-8915, Japan

Authorized officer

Minoru MATSUNAGA

Telephone No. +81-3-3581-1101 Ext. 3571



5V

4237

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/05459

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 8-298555 A (CANON INC) 1996.11.12 (FAMILY: NONE) CLAIM 1,2	9,10
EA	JP 2003-101787 A (RICOH CO LTD) 2003.04.04 (FAMILY: NONE)	1-20
EA	JP 2003-101788 A (RICOH CO LTD) 2003.04.04 (FAMILY: NONE)	1-20
EA	JP 2002-185962 A (RICOH CO LTD) 2002.06.28 (FAMILY: NONE)	1-20
A	JP 9-83808 A (RICOH CO LTD) 1997.03.28 (FAMILY: NONE)	1-20

COPY

1/4

PCT REQUEST

R03016 PCT

Original (for SUBMISSION) - printed on 28.04.2003 11:55:54 AM

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.92 (updated 01.01.2003)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	Japan Patent Office (RO/JP)
0-7	Applicant's or agent's file reference	R03016 PCT
I	Title of invention	METHOD OF PROCESSING IMAGE INFORMATION
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	RICOH COMPANY, LTD.
II-5	Address:	3-6, Nakamagome 1-chome, Ohta-ku, Tokyo 143-8555 Japan
II-6	State of nationality	JP
II-7	State of residence	JP
II-8	Telephone No.	03-3777-8111
II-9	Facsimile No.	03-5742-5429
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	KADOWAKI, Yukio
III-1-5	Address:	242-6, Hourencho, Nara-shi, Nara 630-8113 Japan
III-1-6	State of nationality	JP
III-1-7	State of residence	JP

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PCT REQUEST

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IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	ITOH, Tadahiko
IV-1-2	Address:	32nd Floor, Yebisu Garden Place Tower, 20-3, Ebisu 4-chome, Shibuya-ku, Tokyo 150-6032 Japan
IV-1-3	Telephone No.	03-5424-2511
IV-1-4	Facsimile No.	03-5424-2525
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	EP: AT BE BG CH&LI CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL PT SE SI SK TR and any other State which is a Contracting State of the European Patent Convention and of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	US
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	30 April 2002 (30.04.2002)
VI-1-2	Number	Patent Application 2002-128682
VI-1-3	Country	JP
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	International Searching Authority Chosen	Japan Patent Office (JPO) (ISA/JP)

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PCT REQUEST

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VIII	Declarations	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	Check list	number of sheets	electronic file(s) attached
IX-1	Request (including declaration sheets)	4	-
IX-2	Description	21	-
IX-3	Claims	7	-
IX-4	Abstract	1	EZABST00.TXT
IX-5	Drawings	15	-
IX-7	TOTAL	48	
	Accompanying items	paper document(s) attached	electronic file(s) attached
IX-8	Fee calculation sheet	✓	-
IX-17	PCT-EASY diskette	-	Diskette
IX-18	Other (specified):	Revenue stamps of transmittal and search fee for receiving office	-
IX-18	Other (specified):	Submission of certificate of payment for international fee	-
IX-19	Figure of the drawings which should accompany the abstract		
IX-20	Language of filing of the international application	English	
X-1	Signature of applicant, agent or common representative		
X-1-1	Name	ITOH, Tadahiko	

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	

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PCT REQUEST

Original (for SUBMISSION) - printed on 28.04.2003 11:55:54 AM

10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/JP
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
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REPLACED BY
ART 34 ADT

-22-

CLAIMS

1. A method of processing image information,
comprising the steps of:

encoding said image information by a bit plane;

5 generating an index parameter indexing degradation
of said image information caused by truncation of one or more
bit planes based on said image information; and

compressing said image information by truncating
the bit planes;

10 wherein the bit planes to be truncated are
determined based on said index parameter.

2. The method as claimed in claim 1, further
comprising the step of attaching said index parameter to the
15 encoded image information, wherein the bit planes to be
truncated are determined based on the attached index parameter.

3. The method as claimed in claim 1, further
comprising the step of counting a number of most significant
20 bits of each bit plane of said image information before
encoding, wherein said index parameter is said number of most
significant bits of each bit plane.

4. The method as claimed in claim 3, further
25 comprising the step of predicting distortion of said image

information caused by the truncation of the bit planes based on said number of most significant bits of each bit plane, wherein said index parameter contains the predicted distortion.

5 5. The method as claimed in claim 4, further comprising the step of predicting a slope parameter of said distortion of said image information caused by the truncation of the bit planes based on said number of most significant bits of each bit plane, wherein said index parameter contains
10 the predicted distortion and the predicted slope parameter.

 6. The method as claimed in claim 1, further comprising the step of obtaining an amount of distortion of said image information caused by the truncation of the bit
15 planes based on said image information before encoding, wherein said index parameter contains the obtained amount of distortion.

 7. The method as claimed in claim 6, further
20 comprising the step of obtaining a slope parameter of said distortion of said image information caused by the truncation of the bit planes based on said image information before encoding, wherein said index parameter contains the obtained amount of distortion and the obtained slope parameter.

8. The method as claimed in claim 1, wherein said image information is compressed with JPEG 2000.

9. The method as claimed in claim 2, wherein
5 said image information is compressed with JPEG 2000; and

the generated index parameter is stored in a comment marker of the encoded image information.

10 10. The method as claimed in claim 9, wherein said comment marker is provided in a main header or a tile part header of the encoded image information.

11. An image processing apparatus, comprising:
15 an encoding unit that encodes image information by a bit plane;

an index generating unit that generates index parameter indexing degradation of said image information caused by truncation of one or more bit planes based on said
20 image information; and

a compressing unit that compresses said image information by truncating the bit planes;

wherein the bit planes to be truncated are determined based on said index parameter.

12. The image processing unit as claimed in claim 11, further comprising an index attaching unit that attaches said index parameter to the encoded image information, wherein the bit planes to be truncated are determined based on the attached index parameter.

13. The image processing apparatus as claimed in claim 11, further comprising a counting unit that counts a number of most significant bits of each bit plane of said image information before encoding, wherein said index parameter contains said number of most significant bits of each bit plane.

14. A method of processing image information, comprising the steps of:
encoding said image information by a portion;
generating index parameter indexing degradation of said image information caused by deletion of one or more portions of said image information; and
compressing said image information by deleting the portions;
wherein the portions to be deleted are determined based on said index parameter.

15. An image processing apparatus, comprising:

an encoding unit that encodes image information by
a portion;

an index generating unit that generates index
parameter indexing degradation of said image information
5 caused by deletion of one or more portions of said image
information; and

a compressing unit that compresses said image
information by deleting the portions;

wherein the portions to be deleted are determined
10 based on said index parameter.

16. A computer program that causes a computer to
process image information, comprising the steps of:

encoding said image information by a bit plane;
15 generating index parameter indexing degradation of
said image information caused by truncation of one or more bit
planes based on said image information; and

compressing said image information by truncating
the bit planes;

20 wherein the bit planes to be truncated are
determined based on said index parameter.

17. A method of processing audio information,
comprising the steps of:

25 encoding said audio information by a portion;

generating index parameter indexing degradation of
said audio information caused by deletion of one or more
portions of said audio information; and

compressing said audio information by deleting the
5 portions;

wherein the portions to be deleted are determined
based on said index parameter.

18. An audio processing apparatus, comprising:
10 an encoding unit that encodes audio information by
a portion;

an index generating unit that generates index
parameter indexing degradation of said audio information
caused by deletion of one or more portions of said audio
15 information; and

a compressing unit that compresses said audio
information by deleting the portions;

wherein the portions to be deleted are determined
based on said index parameter.

20

19. A computer program that causes a computer to
process audio information, comprising the steps of:

encoding said audio information by a portion;

generating index parameter indexing degradation of
25 said audio information caused by deletion of one or more

portions of said audio information; and

compressing said audio information by deleting the
portions;

wherein the portions to be deleted are determined
5 based on said index parameter.

20. A computer program that causes a computer to
process image information, comprising the steps of:

encoding said image information by a portion;

10 generating index parameter indexing degradation of
said image information caused by deletion of one or more
portions of said image information; and

compressing said image information by deleting the
portions;

15 wherein the portions to be deleted are determined
based on said index parameter.

10/510136510, 136

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
13 November 2003 (13.11.2003)

PCT

(10) International Publication Number
WO 03/094504 A1

- (51) International Patent Classification⁷: **H04N 1/41**, G10L 11/00, H04N 7/30, H03M 7/30
- (21) International Application Number: PCT/JP03/05459
- (22) International Filing Date: 28 April 2003 (28.04.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 2002-128682 30 April 2002 (30.04.2002) JP
- (71) Applicant (for all designated States except US): **RICOH COMPANY, LTD.** [JP/JP]; 3-6, Nakamagome 1-chome, Ohta-ku, Tokyo 143-8555 (JP).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **KADOWAKI, Yukio** [JP/JP]; 242-6, Hourencho, Nara-shi, Nara 630-8113 (JP).
- (74) Agent: **ITOH, TADAHIKO**; 32nd Floor, Yebisu Garden Place Tower, 20-3, Ebisu 4-chome, Shibuya-ku, Tokyo 150-6032 (JP).
- (81) Designated State (national): US.
- (84) Designated States (regional): European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR).
- Published:
— with international search report
— with amended claims
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF PROCESSING IMAGE AND AUDIO INFORMATION, IMAGE AND AUDIO PROCESSING APPARATUS AND COMPUTER PROGRAM THAT CAUSES A COMPUTER TO PROCESS IMAGE AND AUDIO INFORMATION

	A BIT	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Na	Nb
LAYER 12																		0	0
LAYER 11																		1	0
LAYER 10																		2	1
LAYER 9																		0	0
LAYER 8																		3	1
B LAYER 7																		6	2
LAYER 6																		1	1
LAYER 5																		1	0
LAYER 4																		1	0
LAYER 3																		0	0
LAYER 2																		1	0
LAYER 1																		0	—

(57) Abstract: A method of processing image information in which the image information is encoded by the bit plane and compressed by truncating one or more of the bit planes. Since the index parameter indexing the effect of the truncation on the quality of the image information is generated before the truncation, one can determine the bit planes to be truncated based on the index parameter without decoding the image information.

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DESCRIPTION

**METHOD OF PROCESSING IMAGE AND AUDIO INFORMATION, IMAGE AND AUDIO
PROCESSING APPARATUS AND COMPUTER PROGRAM THAT CAUSES A COMPUTER
TO PROCESS IMAGE AND AUDIO INFORMATION**TECHNICAL

The present invention generally relates to a method
5 of processing image and/or audio information, an image and/or
audio processing apparatus, and a computer program for
processing image and/or audio information.

The present invention more particularly relates to
a method of processing image and/or audio information, an
10 image and/or audio processing apparatus, and a computer
program for processing image and/or audio information, in
which the degrading of the encoded image and/or audio
information caused by the truncation of bit planes can be
evaluated without decoding the encoded image and/or audio
15 information.

BACKGROUND ART

The Joint Photographic Experts Group (JPEG) and
JPEG 2000 are well known international standards of a method
of compressing image data.

20 FIG. 1 is a schematic diagram for explaining a
conventional image processing apparatus that compresses image
information by JPEG 2000. When image data 11 are input to an
image processing apparatus 12, the image data 11 are
transformed with discrete wavelet transformation (DWT) by a
25 transforming unit 13, are quantized by a quantizing unit 14,

are encoded with entropy coding by an encoding unit 15, and are output as encoded data 16. That is, the image information is compressed in the manner in which the image data 11 are transformed into the encoded data 16.

5 In this specification, the "image information" includes the image data 11 and any data derived from the image data 11 such as the transformed image data, the quantized image data, and the encoded image data encoded with the entropy encoding.

10 FIG. 2 is a schematic diagram showing a conventional image processing apparatus that decompresses the image information. When encoded data 21 are input to an image processing apparatus 22, the encoded data 21 are decoded with entropy decoding by a decoding unit 23, are reversely
15 quantized by a reverse quantizing unit 24, are reversely transformed with reverse discrete wavelet transformation by a reverse transforming unit 25, and are output as image data 26. That is, the image information, the encoded data 21 in this case, is decompressed into the image data 26.

20 The image processing apparatus that compresses the image information and the image processing apparatus that decompresses the image information are often combined as an image processing system.

 The transforming unit 13 will be described by
25 reference to FIGs. 3A and 3B. In the case of JPEG 2000, the

image data 11 are generally divided into tiles 31 as showed in FIG. 3A. Each tile 31 is transformed with DWT as showed in FIG. 3B. FIGs 3A and 3B illustrate the case in which the image data 11 are divided into the tiles 31 of 128 x 128 pixels. If a
5 tile 31 of 128 x 128 pixels is transformed with DWT of level 2, the transformation generates wavelet coefficient data 32 for three 64 x 64 sub-bands 1LH, 1HL, and 1HH and four 32 x 32 sub-bands 2LL, 2LH, 2HL, and 2HH.

The quantizing unit 14 will be described by
10 reference to FIG. 4. FIG. 4 shows an example of formula to be used for quantizing, where "a" and "b" are the wavelet coefficients before and after quantizing, respectively; " $|a|$ " is the absolute value of "a"; "sign(a)" is the sign of "a"; " $\lfloor \cdot \rfloor$ " is floor function; and " Δ " is a quantizing step. The
15 wavelet coefficient "a" is quantized to "b" by this formula.

The encoding unit 15 will be described by reference to FIG. 5. In the case of JPEG 2000, the sub-band 52 of the quantized wavelet coefficient data 51 is divided into code blocks 53 as showed in FIG. 5A. (If a sub-band is larger than
20 a code block, the sub-band is divided into the code blocks. In the following description, a code block includes a sub-band that is not divided into code blocks.)

The code blocks 53 are further divided into bit planes 54 as showed in FIG. 5B. Each bit plane is encoded with
25 entropy encoding such as arithmetic encoding as showed in FIG.

5C. FIG. 5A illustrates the case in which the sub-band 52 is divided into the 4 x 4 code blocks 53. (The size of each code block 53 is 4 x 4 in this case, but the size is not limited to 4 x 4.) FIG. 5B illustrates the case in which the 4 x 4 code block 53 is divided into four bit planes 54. The encoding unit 15 encodes with entropy encoding each bit plane 54 of the quantized wavelet coefficient data 51, and outputs the encoded data 16.

In the above description, the image data 11 are assumed to represent a monochrome image. In the case in which the image data 11 represent a color image, the image data (component) of each color can be input to the image processing apparatus 12 as showed in FIGs. 6A and 6B. The image data represented by RGB format may be directly input to the image processing apparatus 12 as showed in FIG. 6A. The image data represented by RGB format may be converted into another format such as YCbCr format before being input to the image processing apparatus. In the case of JPEG 2000, the image data represented by the RGB format are generally converted into the YCbCr format as showed in FIG. 6B. Since human eyes are not as sensitive to the color difference components (Cb and Cr) as they are to the brightness component (Y), one can increase data compression rate by compressing Cb and Cr more than Y.

As described above, in the case of JPEG 2000, the quantized wavelet coefficient data are divided into bit planes,

and encoded by the bit plane. If some bit planes are cut off, the image data are further compressed. For example, the image data can be compressed by cutting off (truncating) the lower side of the encoded bit planes.

5 If a compression ratio is given as a target, data are cut off until the compression ratio reaches the target. If data are cut off, image quality is degraded. Accordingly, it is necessary to determine, when the data are cut off to a certain extent, how much the image quality degrades.

10 According to a method of determining the extent of the degrading showed in "Example and Guideline" (EG) of JPEG 2000, the bit planes are truncated one by one from the lowest bit plane to the highest bit plane, and the distortion is obtained after each truncation of a bit plane. For example,
15 the lowest bit plane is truncated, and the distortion is obtained. Then, the second lowest bit plane is additionally truncated, and the distortion is obtained. This procedure is continued until the highest bit plane is truncated and the distortion is obtained. The distortion is obtained by decoding
20 the encoded data after each truncation and comparing the decoded data with the original image data. The distortion is defined as mean squared error (MSE).

 Since the encoded data after each truncation are decoded as described above, it takes long time to obtain the
25 distortion. Otherwise, hardware that accelerates the above

procedure is additionally required.

DISCLOSURE OF THE INVENTION

Accordingly, it is a general object of the present invention to provide a novel and useful method of processing
5 image data in which one or more of the above problems are eliminated. A more specific object of the present invention is to provide a method of evaluating a distortion caused by truncation of bit planes without decoding encoded data.

To achieve one of the above problems, a method of
10 processing image information, according to an aspect of the present invention, includes the step of encoding said image information by a bit plane; the step of generating index parameter indexing degradation of said image information caused by truncation of one or more bit planes based on said
15 image information; and the step of compressing said image information by truncating the bit planes; wherein the bit planes to be truncated are determined based on said index parameter.

When truncating the bit planes of the encoded image
20 information, one can evaluate the degradation of the image information caused by the truncation based on the index parameter generated in advance without decoding the image information.

Other objects, features and advantages of the
25 present invention will become more apparent from the following

detailed description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing an image processing apparatus that compresses image information with JPEG 2000;

FIG. 2 is a block diagram showing an image processing apparatus that decompresses image information with JPEG 2000;

FIGS. 3A and 3B are schematic diagrams for explaining a transforming unit;

FIG. 4 shows a formula used for a quantizing unit;

FIGS. 5A through 5C are schematic diagrams for explaining an encoding unit;

FIGS. 6A and 6B are schematic diagrams for explaining an image processing apparatus that handles a color image;

FIG. 7 is a block diagram showing an image processing apparatus according to an embodiment of the present invention;

FIG. 8 is a schematic diagram showing bit planes and layers;

FIG. 9 is a schematic diagram showing the bit pattern of a layer according to an embodiment;

FIG. 10 is a schematic diagram showing the bit

pattern of a layer according to an embodiment where layers 1 through 3 are truncated;

FIG. 11 is a schematic diagram showing the bit pattern of a layer according to an embodiment where layers 1 through 6 are truncated;

FIG. 12 is a schematic diagram showing the bit pattern of a layer according to an embodiment where layers 1 through 7 are truncated;

FIG. 13 is a schematic diagram showing the bit pattern of a layer according to an embodiment where layers 1 through 8 are truncated;

FIG. 14 is a schematic diagram showing the bit pattern of layers and "Na" and "Nb" of each layer;

FIG. 15 illustrates a bit pattern that gradually changes;

FIG. 16 illustrates a bit pattern that steeply changes;

FIG. 17 illustrates the format of encoded wavelet coefficient data;

FIG. 18 illustrates the configuration of a main header; and

FIG. 19 illustrates the configuration of a tile part header.

BEST MODE FOR CARRYING OUT THE INVENTION

A detailed description of the preferred embodiments

will be described by reference to the drawings.

[FIRST EMBODIMENT]

FIG. 7 is a block diagram showing an image processing apparatus according to an embodiment of the present invention. In FIG. 7, an image processing apparatus 12 is configured by a transforming unit 13, a quantizing unit 14, an encoding unit 15, an index generating unit, a counting unit, a distortion predicting unit 73, a slope parameter predicting unit 74, an index adding unit 75, and a compressing unit 76. The image processing apparatus 12 compresses image data with JPEG 2000. The input image data 11 are transformed with the discrete wavelet transformation by the transforming unit 13, quantized by the quantizing unit 14, encoded with entropy codes by the encoding unit 15, and output as the encoded data 16.

FIG. 8 is a schematic diagram showing bit planes 54 and corresponding layers according to an embodiment of the present invention. As described above, the code block 53 of the wavelet coefficient data 51 is divided into the bit planes 54. In the case of JPEG 2000, each bit plane is encoded with three paths (coding path) of the entropy code. The group of coding paths is called a layer. In this description, the group of coding paths is assumed to correspond to a layer to make the description easy. That is, it is assumed that the bit plane and a layer corresponding thereto are identical.

The truncation of layers (bit planes) will be discussed below.

FIG. 9 is a schematic diagram showing the bit pattern of layers 1 through 12 in the case where the layers 1 through 12 are cut at a surface "A" as showed in FIG. 8. Though a layer is two dimensional, only one dimensional bit pattern will be described since the description of the one-dimensional case is easier and those skilled in the art will easily understand the two dimensional case base on the one-dimensional case. In FIG. 9, a box is white if the component corresponding thereto is ineffective (ineffective bit), and is black if the component corresponding thereto is effective (effective bit).

FIG. 10 shows the bit pattern in the case where the layers 1 through 3 are truncated. In this case, most of the effective components remain undeleted. FIG. 11 shows the bit pattern in the case where the layers 1 through 6 are truncated. In this case, even if the layers 1 through 6 are truncated, most of the most significant bits (MSBs) are not truncated. FIG. 12 shows the bit pattern in the case where the layers 1 through 7 are truncated. In this case, more than half data items are deleted due to the truncation. FIG. 13 shows the bit pattern in the case where the layers 1 through 8 are truncated. In this case, most of the data items are deleted.

FIG. 14 is the same schematic diagram as FIG. 9

except that the number of MSBs is indicated as "Na" for each layer and the number of MSBs each followed by the second most significant bit that is effective is indicated as "Nb" for each layer. FIG. 14 shows that many MSBs are distributed at the layer 7.

FIG. 15 and FIG. 16 illustrate other examples of bit patterns. The bit pattern showed in FIG. 15 gradually changes, and the MSBs are widely distributed over several layers. The bit pattern showed in FIG. 16, however, steeply changes between the bit 7 and 8. The MSBs are distributed at only layers 1 through 4 and layers 9 through 11.

In the case of FIG. 14, for example, if the layer 7 at which many MSBs are distributed is truncated, the data distribution of the code block of the layer substantially changes. That is, the more MSBs are deleted when a layer is truncated, the more the image quality degrades.

As described above, the number of MSBs of each layer is a parameter that indexes the degrading of the image quality. It is easy to obtain the number of MSBs from the wavelet coefficient data. Accordingly, one can evaluate the degrading of an image due to the truncation easily and quickly based on the number of MSBs.

Furthermore, when the bit planes of the encoded data are truncated, the degrading of an image due to the truncation of bit planes can be evaluated without decoding the

encoded data encoded with the entropy code.

For example, if one obtains the number of MSBs of each bit plane in advance based on the wavelet coefficient data before encoded with the entropy code, and attaches the
5 obtained number of MSBs to the wavelet coefficient data after the entropy encoding or stores the obtained number of MSBs in a storing unit, the one can evaluate, without entropy decoding, the degrading of the image due to truncations using the obtained number of MSBs that is attached or stored.

10 If one predicts the image distortion of the image due to the truncations of bit planes or a slope parameter (the ratio of the distortion of the image to the amount of reduced image data by the truncation), and attaches the predicted distortion or slope parameter, instead of the obtained number
15 of MSBs, to the wavelet coefficient data after the entropy encoding or stores the predicted value in the storing unit, the one can evaluate, without entropy decoding, the degrading of the image due to the truncations using the predicted distortion or slope parameter that is attached or stored.

20 In the following description, the parameters that indicate the degrading of the image due to the truncation of bit planes such as the number of MSBs of each bit plane, the distortion of the image, and the slope parameter will be called "index parameter".

25 According to the first embodiment, the encoding

unit 15 provides the index generating unit 71 with the wavelet coefficient data 51 before entropy encoding (referred to as "wavelet coefficient data 77 before entropy encoding") as showed in FIG. 7. The counting unit 72 provided in the index generating unit 71 counts the number (Na) of MSBs of each bit plane in the wavelet coefficient data 77 before entropy encoding.

According to the first embodiment, the counting unit 72 provides "Na" to the distortion predicting unit 73 and the slope parameter predicting unit 74 provided in the index generating unit 71 as showed in FIG. 7. The distorting predicting unit 73 and the slope parameter predicting unit 74 predict the distortion of the image and the slope parameter, respectively, based on "Na" provided from the counting unit 72.

In the case where bit planes 1 through "n" are truncated, the distortion value of the image of this case may be defined as the sum of "Na" multiplied by the level of each bit plane. For example, in the case of FIG. 11, the distortion value of the image is calculated as: $0 \times 1 + 1 \times 2 + 0 \times 3 + 1 \times 4 + 1 \times 5 + 1 \times 6 = 17$. Accordingly, the slope parameter can be defined as the ratio of the above distortion value to the amount of data reduced by the truncation.

According to the first embodiment of the present invention, the encoding unit 15 provides the compressing unit 76 with the wavelet coefficient data 51 after entropy encoding

(referred to as "wavelet coefficient data 78 after entropy encoding") as showed in FIG. 7. Additionally, the index generating unit 71 provides the compressing unit 76 with index values generated in advance such as the obtained "Na" and the predicted distortion. The compressing unit 76 determines bit planes to be truncated based on the index values provided by the index generating unit 71, and truncates the determined bit planes.

For example, one may set a predetermined threshold for each bit plane 54, and compare the index value generated by the index generating unit 71 with the predetermined threshold. The index value of the bit plane 1 is compared with corresponding threshold; the index value of the bit plane 2 is compared with corresponding threshold; and so on. If the index value of the bit plane "n" exceeds corresponding threshold for the first time, the bit planes 1 through "n-1" are determined to be truncated. If the index value of the bit plane 1 exceeds corresponding threshold, that is, $n=1$, no bit plane is truncated. The thresholds may be the same, or may be different.

As described above, the compressing unit 76 can determine, without entropy decoding, the bit planes to be truncated that does not degrade too much using the index values generated by the index generating unit 71.

According to the embodiment, the encoding unit 15 provides the index adding unit 75 with the wavelet coefficient

data 78 after entropy encoding, and the index generating unit 71 provides the index adding unit 75 with the index values generated in advance as showed in FIG. 7 so that the index adding unit 75 can attach the index values to the wavelet coefficient data 78.

After attaching the index values to the wavelet coefficient data 78, the index adding unit 75 provides the compressing unit 76 with the wavelet coefficient data 78. The compressing unit 76 can determine the bit planes to be truncated based on the index values attached to the wavelet coefficient data 78 and truncate them.

Accordingly, the compressing unit 76 can determine, without entropy decoding, the bit planes 54 to be truncated using the index values attached to the wavelet coefficient data 78 generated by the index generating unit in advance, and can truncate the determined bit planes.

The wavelet coefficient data 78 after entropy encoding according to JPEG 2000 will be described below. FIG. 17 illustrates the format of the "wavelet coefficient data 78 after entropy encoding". The image processing apparatus showed in FIG. 1 outputs the encoded data 16 of this format.

In the case of the image processing apparatus according to the embodiment showed in FIG. 7, the wavelet coefficient data 78 after entropy encoding are further processed by the compressing unit 76, and are output as the

encoded data 16.

In general and in this specification, the term "encoded data" includes not only the encoded data 16 output by the image processing apparatus but also the wavelet coefficient data 78 after entropy encoding.

The encoded data of FIG. 17 starts with a main header 171 including "start of codestream" (SOC) 173 and "main" 174 that is the body of the main header 171.

A tile part header 172A follows the main header 171.

10 The tile part header includes a "start of tile" (SOT) 175A indicating the start of the tile part header 172S, a "tile (A) header maker segment" (T(A)) 176A indicating the content of the tile part header 172A, and a "start of data" (SOD) 177A indicating the start of data.

15 A bit stream 178A follows the tile part header 172A.

A plurality of tile part headers 172B, 172C, ..., each followed by a bit stream 178B, 178C, ..., respectively follows the bit stream 178A, if applicable. The "end of codestream" (EOC) 179 indicating the end of the codestream
20 follows the last bit stream.

FIG. 18 illustrates the configuration of the main header 171. As described above, the main header 171 starts with SOC 173 followed by a marker SIZ (image and tile size) 181 indicating the size. SIZ 181 is followed by the following
25 markers in an arbitral order: COD (coding style default) 182

required for encoding and decoding, COC (coding style component) 183, QCD (quantization default) 184 required for quantizing and reverse quantizing, QCC (quantization component) 185, RGN (region of interest) 186, POC (order charge) 187, PPM (packed packet headers) 191, TLM (tile lengths) 192, PLM (packet lengths) 193, CRG (component registration) 194, and COM (component) 188, where SIZ, COD, and QCD are required but the others are optional.

FIG. 19 illustrates the configuration of the tile part header 172. The tile part header 172 starts with SOT 175 followed, in any order, by the following markers: COD 182, COC 183, QCD 184, QCC 185, RGN 186, POC 187, PPT (packed packet headers, tile header) 195, PLT (packet lengths, tile header) 196, and COM 188, where QCD 184 is required and the other markers are optional. Then, SOD 177 follows the above markers.

As described above, the index adding unit 75 attaches the index values generated by the index generating unit 71 to the encoded data of JPEG 2000. According to the current format of the encoded data of JPEG 2000, one can insert a comment marker in which the one can store comment text in the encoded data of JPEG 2000. The index values can be stored in the comment marker. The comment marker may be provided in the main header 171 or the tile part header 172. Otherwise, the comment marker may be provided in a header dedicated for the comment marker.

In the above description, the bit plane of (quantized) wavelet coefficient data is considered. The present invention, however, is also applicable to the bit plane of other image information.

5 In the above description, the number of MSBs of each bit plane and so forth are used as an index parameter. The present invention, however, is not limited to those index parameters described above, and can use any parameter that indexes the degrading of the image due to the truncation of
10 bit planes.

For example, the present invention can use the distortion and/or the slope parameter caused by the truncation of the bit planes using the methods described in the EG of JPEG 2000 as the index parameters. One can provide a
15 distortion obtaining unit and/or a slope parameter obtaining unit instead of the counting unit 72 in the image processing apparatus according to the embodiment.

In the above description, it is assumed that the image data are compressed with JPEG 2000. The present
20 invention, however, is not limited to JPEG 2000, and is applicable to any other image compression method in which the image information is encoded by the bit plane, and the encoded image information are compressed by truncating the bit planes.

Additionally, the present invention is not limited
25 to the case where the image information is encoded by the bit

plane, and the encoded image information is compressed by truncating the bit planes. The present invention is also applicable to the case where the image information is encoded part by part, and the each encoded part of the image information is compressed by reducing the encoded part.

The present invention is also applicable to audio information such as voice data instead of the image information such as the image data.

[SECOND EMBODIMENT]

10 An MSB embodies a half of the amount of information contained in a data item. If the second most significant bit (second MSB), that is, the bit subsequent to the MSB is "1" (effective bit), the MSB and the second MSB holds $1/2$ through $3/4$, in total, of the amount of information contained in the data item. If the second MSB is otherwise "0", the MSB and the second MSB hold $3/4$ through 1 of the amount of information contained in the data item in total. Accordingly, the distortion of an image can be evaluated more accurately based on not only the number (N_a) of MSBs but also the number (N_b) of MSBs followed by second MSB that is 1. For example, one may assume that an MSB followed by a second MSB that is 0 is 1.5 times effective on the degrading of the image than an MSB followed by a second MSB that is 1, in other words, the MSB followed by a second MSB that is 0 corresponds to 1.5 MSBs followed by a second MSB that is 1.

When predicting the distortion of an image and the slope parameter, the distortion predicting unit 73 and the slope parameter predicting unit 74 may not necessarily handle all code blocks equally. The distortion predicting unit 73 and the slope parameter predicting unit 74 may weight each code block based on the component and the sub band so that the degrading of the image can be accurately evaluated.

If the encoding unit 15 can compress with entropy encoding the wavelet coefficient data 51 at a compression rate more than desired one, the compressing unit 76 does not need to truncate the bit planes. The compressing unit 76 does not need in this case to attach the index value to the wavelet coefficient data 51.

The index adding unit 75 attaches the index value to the wavelet coefficient data 51, but can be selectively set, in response to an instruction from an exterior, not to attach the index value to the wavelet coefficient data 51 so as not to lower the compression rate by attaching the index value unnecessarily.

When a plurality of code blocks in a sub band is truncated at different truncation level, the truncation sometimes causes visible distortion between the code blocks. To solve this problem, the truncation is generally executed by the sub band instead of code block. When the truncation is executed by the sub band, one can obtain the number of MSBs by

the sub band instead of by the code block so as to reduce required calculation.

The preferred embodiments of the present invention are described above. The present invention is not limited to these embodiments, but various variations and modifications may be made without departing from the scope of the present invention.

This patent application is based on Japanese Laid-open Patent Application No. 2002-128682 filed on April 30, 2002, the entire contents of which are hereby incorporated by reference.

INDUSTRY APPLICABILITY

In the case of JPEG 2000, for example, image information is encoded by the bit plane, and is compressed by truncating the bit planes of the encoded image information. When truncating the encoded bit planes, one can evaluate, using the method of processing image information according to the present invention, the degrading of the image information caused by the truncation without decoding the encoded image information.

CLAIMS

1. A method of processing image information,
comprising the steps of:

encoding said image information by a bit plane;

5 generating an index parameter indexing degradation
of said image information caused by truncation of one or more
bit planes based on said image information; and

compressing said image information by truncating
the bit planes;

10 wherein the bit planes to be truncated are
determined based on said index parameter.

2. The method as claimed in claim 1, further
comprising the step of attaching said index parameter to the
15 encoded image information, wherein the bit planes to be
truncated are determined based on the attached index parameter.

3. The method as claimed in claim 1, further
comprising the step of counting a number of most significant
20 bits of each bit plane of said image information before
encoding, wherein said index parameter is said number of most
significant bits of each bit plane.

4. The method as claimed in claim 3, further
25 comprising the step of predicting distortion of said image

information caused by the truncation of the bit planes based on said number of most significant bits of each bit plane, wherein said index parameter contains the predicted distortion.

5 5. The method as claimed in claim 4, further comprising the step of predicting a slope parameter of said distortion of said image information caused by the truncation of the bit planes based on said number of most significant bits of each bit plane, wherein said index parameter contains
10 the predicted distortion and the predicted slope parameter.

 6. The method as claimed in claim 1, further comprising the step of obtaining an amount of distortion of said image information caused by the truncation of the bit
15 planes based on said image information before encoding, wherein said index parameter contains the obtained amount of distortion.

 7. The method as claimed in claim 6, further
20 comprising the step of obtaining a slope parameter of said distortion of said image information caused by the truncation of the bit planes based on said image information before encoding, wherein said index parameter contains the obtained amount of distortion and the obtained slope parameter.

8. The method as claimed in claim 1, wherein said image information is compressed with JPEG 2000.

9. The method as claimed in claim 2, wherein
5 said image information is compressed with JPEG 2000; and

the generated index parameter is stored in a comment marker of the encoded image information.

10 10. The method as claimed in claim 9, wherein said comment marker is provided in a main header or a tile part header of the encoded image information.

11. An image processing apparatus, comprising:
15 an encoding unit that encodes image information by a bit plane;

an index generating unit that generates index parameter indexing degradation of said image information caused by truncation of one or more bit planes based on said
20 image information; and

a compressing unit that compresses said image information by truncating the bit planes;

wherein the bit planes to be truncated are determined based on said index parameter.

12. The image processing unit as claimed in claim 11, further comprising an index attaching unit that attaches said index parameter to the encoded image information, wherein the bit planes to be truncated are determined based on the
5 attached index parameter.

13. The image processing apparatus as claimed in claim 11, further comprising a counting unit that counts a number of most significant bits of each bit plane of said
10 image information before encoding, wherein said index parameter contains said number of most significant bits of each bit plane.

14. A method of processing image information,
15 comprising the steps of:
encoding said image information by a portion;
generating index parameter indexing degradation of said image information caused by deletion of one or more portions of said image information; and
20 compressing said image information by deleting the portions;
wherein the portions to be deleted are determined based on said index parameter.

25 15. An image processing apparatus, comprising:

an encoding unit that encodes image information by
a portion;

an index generating unit that generates index
parameter indexing degradation of said image information
5 caused by deletion of one or more portions of said image
information; and

a compressing unit that compresses said image
information by deleting the portions;

wherein the portions to be deleted are determined
10 based on said index parameter.

16. A computer program that causes a computer to
process image information, comprising the steps of:

encoding said image information by a bit plane;
15 generating index parameter indexing degradation of
said image information caused by truncation of one or more bit
planes based on said image information; and

compressing said image information by truncating
the bit planes;

20 wherein the bit planes to be truncated are
determined based on said index parameter.

17. A method of processing audio information,
comprising the steps of:

25 encoding said audio information by a portion;

generating index parameter indexing degradation of
said audio information caused by deletion of one or more
portions of said audio information; and

compressing said audio information by deleting the
5 portions;

wherein the portions to be deleted are determined
based on said index parameter.

18. An audio processing apparatus, comprising:
10 an encoding unit that encodes audio information by
a portion;

an index generating unit that generates index
parameter indexing degradation of said audio information
caused by deletion of one or more portions of said audio
15 information; and

a compressing unit that compresses said audio
information by deleting the portions;

wherein the portions to be deleted are determined
based on said index parameter.

20

19. A computer program that causes a computer to
process audio information, comprising the steps of:

encoding said audio information by a portion;

generating index parameter indexing degradation of
25 said audio information caused by deletion of one or more

portions of said audio information; and

compressing said audio information by deleting the
portions;

wherein the portions to be deleted are determined
5 based on said index parameter.

20. A computer program that causes a computer to
process image information, comprising the steps of:

encoding said image information by a portion;
10 generating index parameter indexing degradation of
said image information caused by deletion of one or more
portions of said image information; and

compressing said image information by deleting the
portions;

15 wherein the portions to be deleted are determined
based on said index parameter.

AMENDED CLAIMS

[received by the International Bureau on 31 July 2003 (31.07.03);
original claims 1-18 amended; original claims 19 and 20 cancelled (9 pages)]

1. (Amended) A method of processing image
information, comprising the steps of:

5 encoding said image information by a bit plane;
 generating an index parameter indexing degradation
of said image information caused by truncation of one or more
bit planes based on said image information;
 compressing said image information by truncating
10 the bit planes; and
 attaching said index parameter to the encoded image
information;
 wherein the bit planes to be truncated are
determined based on the attached index parameter.

15

2. (Amended) A method of processing image
information, comprising the steps of:

 encoding said image information by a bit plane;
 generating an index parameter indexing degradation
20 of said image information caused by truncation of one or more
bit planes based on said image information;
 compressing said image information by truncating
the bit planes determined based on said index parameter; and
 counting a number of most significant bits of each
25 bit plane of said image information before encoding;

wherein said index parameter is said number of most significant bits of each bit plane.

5 3. (Amended) The method as claimed in claim 2,
further comprising the step of predicting distortion of said
image information caused by the truncation of the bit planes
based on said number of most significant bits of each bit
plane, wherein said index parameter contains the predicted
10 distortion.

 4. (Amended) The method as claimed in claim 3,
further comprising the step of predicting a slope parameter of
said distortion of said image information caused by the
15 truncation of the bit planes based on said number of most
significant bits of each bit plane, wherein said index
parameter contains the predicted distortion and the predicted
slope parameter.

20 5. (Amended) The method as claimed in claim 1,
further comprising the step of obtaining an amount of
distortion of said image information caused by the truncation
of the bit planes based on said image information before
encoding, wherein said index parameter contains the obtained
25 amount of distortion.

6. (Amended) The method as claimed in claim 5,
further comprising the step of obtaining a slope parameter of
said distortion of said image information caused by the
5 truncation of the bit planes based on said image information
before encoding, wherein said index parameter contains the
obtained amount of distortion and the obtained slope parameter.

7. (Amended) The method as claimed in claim 1,
10 wherein said image information is compressed with JPEG 2000.

8. (Amended) The method as claimed in claim 1,
wherein said image information is compressed with JPEG 2000;
and the generated index parameter is stored in a comment
15 marker of the encoded image information.

9. (Amended) The method as claimed in claim 8,
wherein said comment marker is provided in a main header or a
tile part header of the encoded image information.

20

10. (Amended) An image processing apparatus,
comprising:
an encoding unit that encodes image information by
a bit plane;
25 an index generating unit that generates index

parameter indexing degradation of said image information
caused by truncation of one or more bit planes based on said
image information;

5 a compressing unit that compresses said image
information by truncating the bit planes; and
 an index attaching unit that attaches said index
parameter to the encoded image information;

 wherein the bit planes to be truncated are
10 determined based on the attached index parameter.

11. (Amended) An image processing apparatus,
comprising:

 an encoding unit that encodes image information by
15 a bit plane;

 an index generating unit that generates index
parameter indexing degradation of said image information
caused by truncation of one or more bit planes based on said
image information;

20 a compressing unit that compresses said image
information by truncating the bit planes determined based on
said index parameter; and

 a counting unit that counts a number of most
significant bits of each bit plane of said image information
25 before encoding;

wherein said index parameter contains said number of most significant bits of each bit plane.

5 12. (Amended) A method of processing image information, comprising the steps of:

 encoding said image information by a portion;

 generating index parameter indexing degradation of said image information caused by deletion of one or more

10 portions of said image information;

 compressing said image information by deleting the portions; and

 attaching said index parameter to the encoded image information;

15 wherein the portions to be deleted are determined based on said index parameter.

 13. (Amended) An image processing apparatus, comprising:

20 an encoding unit that encodes image information by a portion;

 an index generating unit that generates index parameter indexing degradation of said image information caused by deletion of one or more portions of said image

25 information;

a compressing unit that compresses said image information by deleting the portions; and

an index attaching unit that attaches said index parameter to the encoded image information;

wherein the portions to be deleted are determined based on said index parameter.

14. (Amended) A computer program that causes a computer to process image information, comprising the steps of:

encoding said image information by a bit plane;

generating index parameter indexing degradation of said image information caused by truncation of one or more bit planes based on said image information;

compressing said image information by truncating the bit planes; and

attaching said index parameter to the encoded image information;

wherein the bit planes to be truncated are determined based on the attached index parameter.

15. (Amended) A method of processing audio information, comprising the steps of:

encoding said audio information by a portion;

generating index parameter indexing degradation of
said audio information caused by deletion of one or more
portions of said audio information;

5 compressing said audio information by deleting the
portions; and

 attaching said index parameter to the encoded audio
information;

 wherein the portions to be deleted are determined
10 based on said index parameter.

16. (Amended) An audio processing apparatus,
comprising:

 an encoding unit that encodes audio information by
15 a portion;

 an index generating unit that generates index
parameter indexing degradation of said audio information
caused by deletion of one or more portions of said audio
information;

20 a compressing unit that compresses said audio
information by deleting the portions; and

 an index attaching unit that attaches said index
parameter to the encoded audio information;

 wherein the portions to be deleted are determined
25 based on said index parameter.

17. (Amended) A computer program that causes a computer to process audio information, comprising the steps of:

5 encoding said audio information by a portion;
 generating index parameter indexing degradation of
said audio information caused by deletion of one or more
portions of said audio information;
 compressing said audio information by deleting the
10 portions;
 attaching said index parameter to the encoded audio
information; and
 wherein the portions to be deleted are determined
based on said index parameter.

15

18. (Amended) A computer program that causes a computer to process image information, comprising the steps of:

 encoding said image information by a portion;
20 generating index parameter indexing degradation of
said image information caused by deletion of one or more
portions of said image information;
 compressing said image information by deleting the
portions; and
25 attaching said index parameter to the encoded image

information;

wherein the portions to be deleted are determined
based on said index parameter.

5

FIG.1

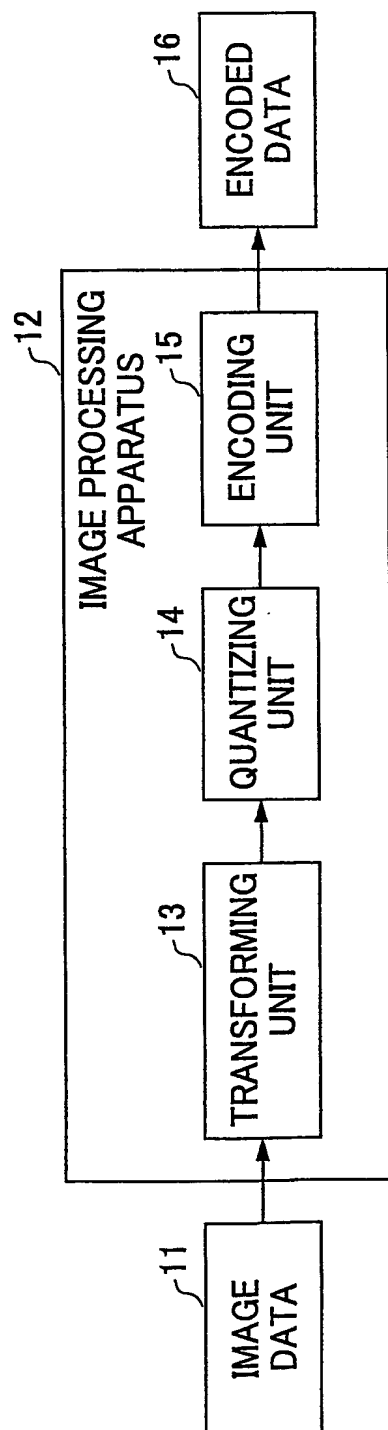


FIG.2

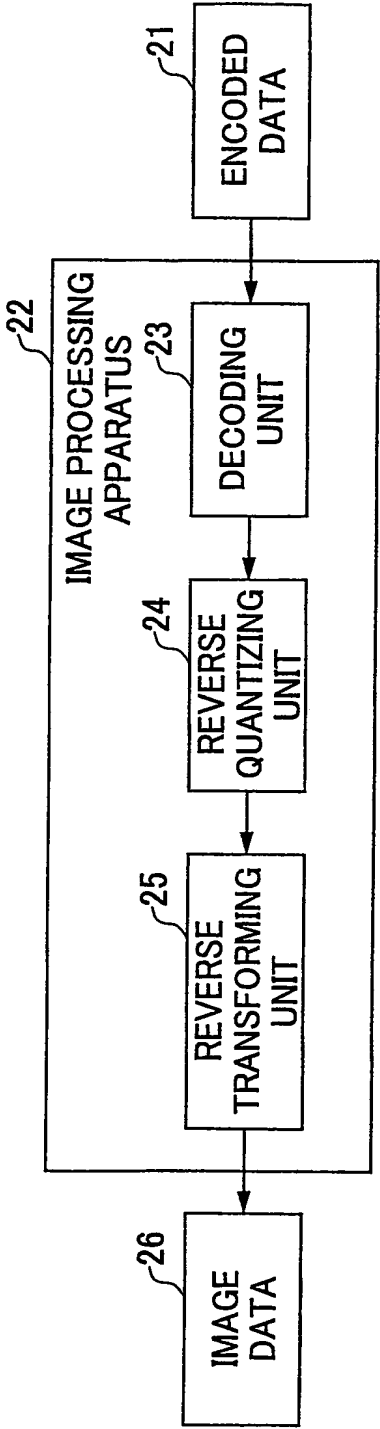


FIG.3A

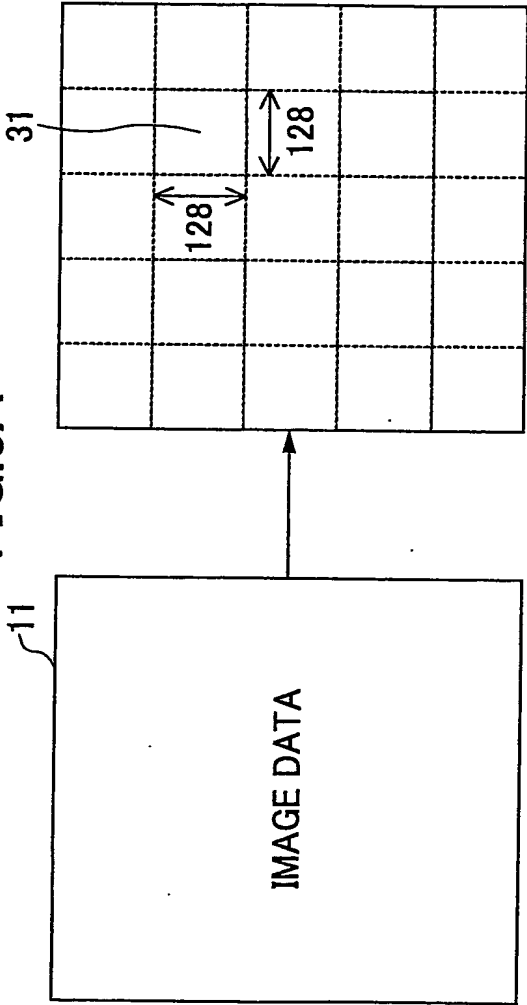
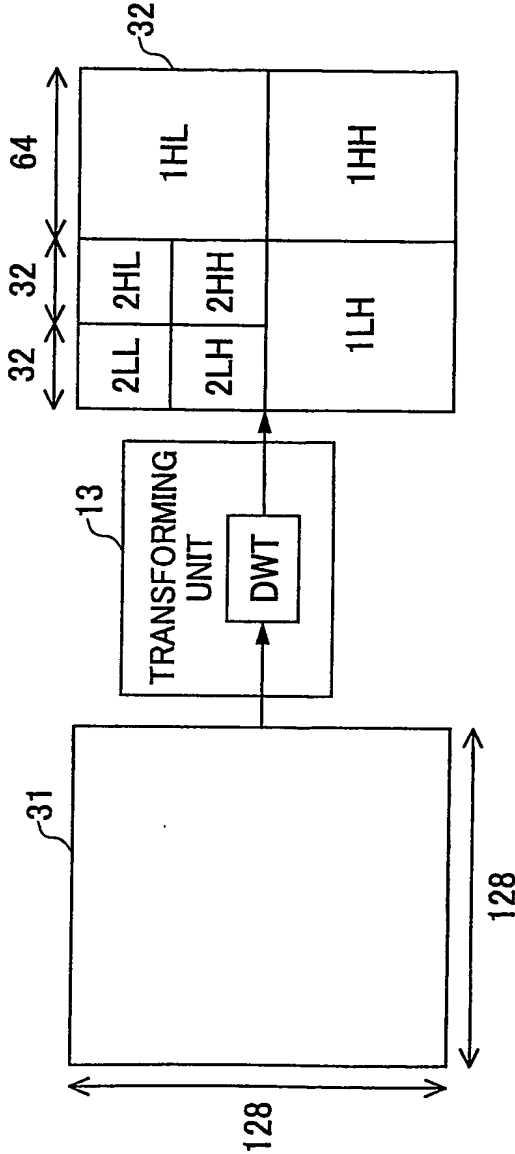


FIG.3B



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FIG.4

$$b = \text{sign}(a) \cdot \left[\frac{|a|}{\Delta} \right]$$

FIG.5A

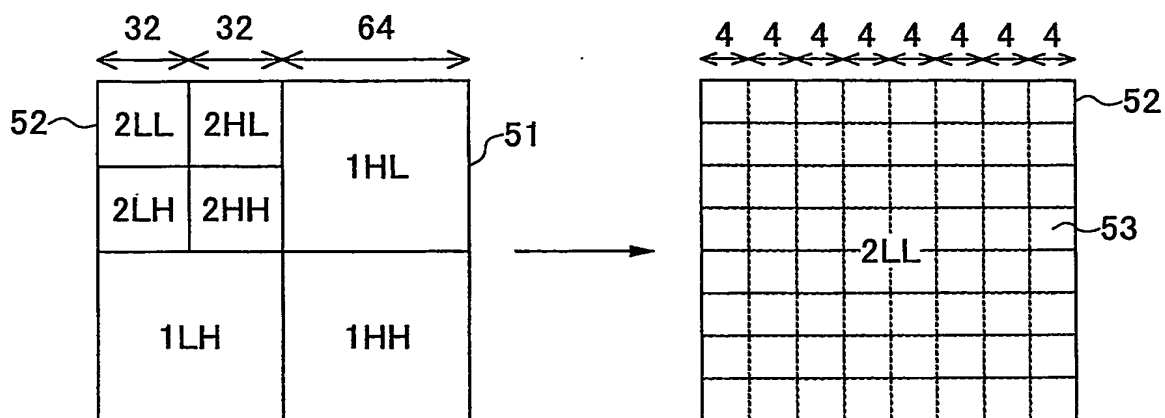


FIG.5B

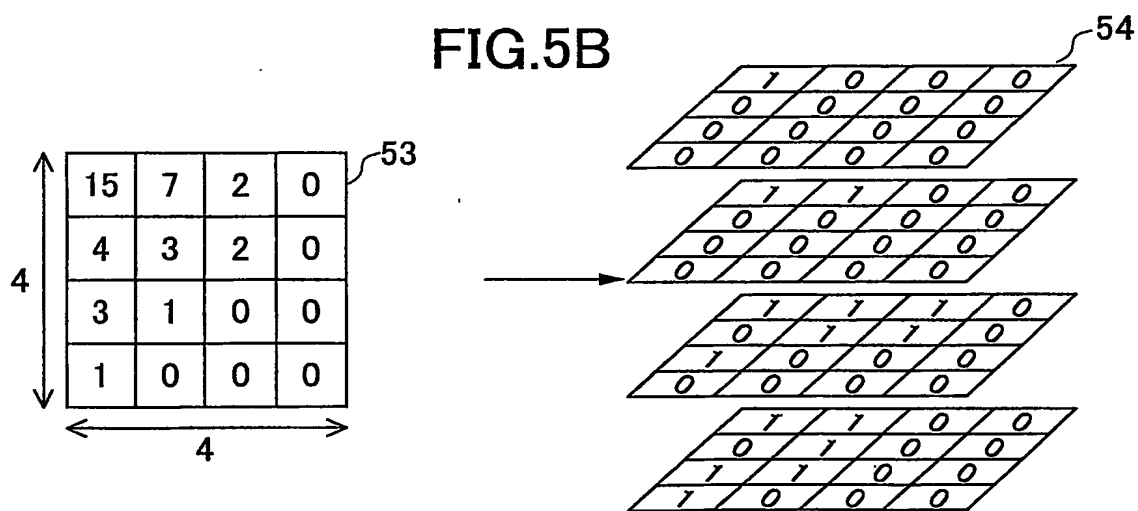
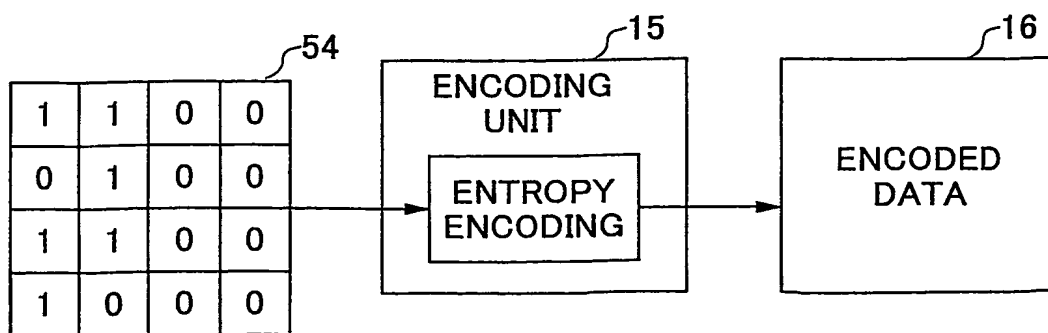


FIG.5C



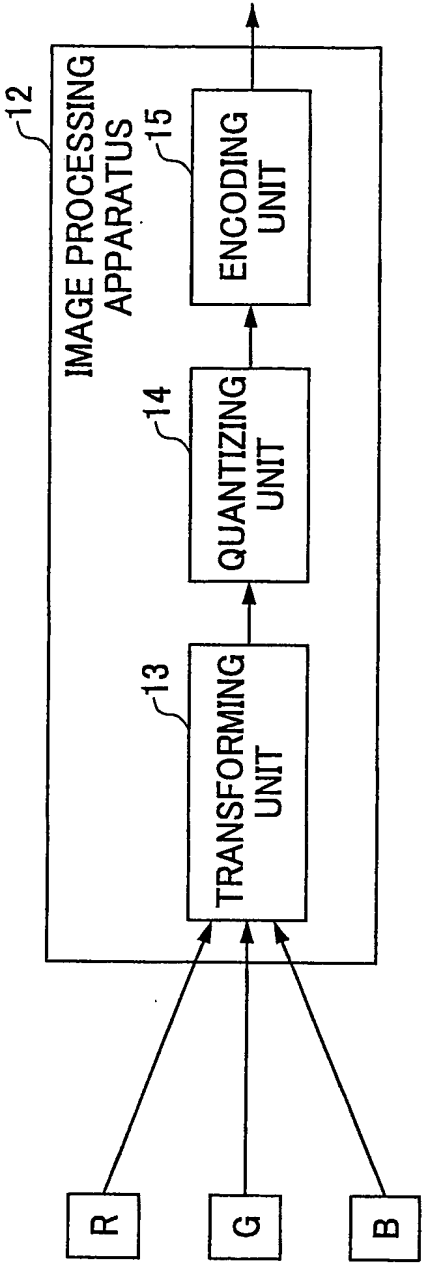


FIG. 6A

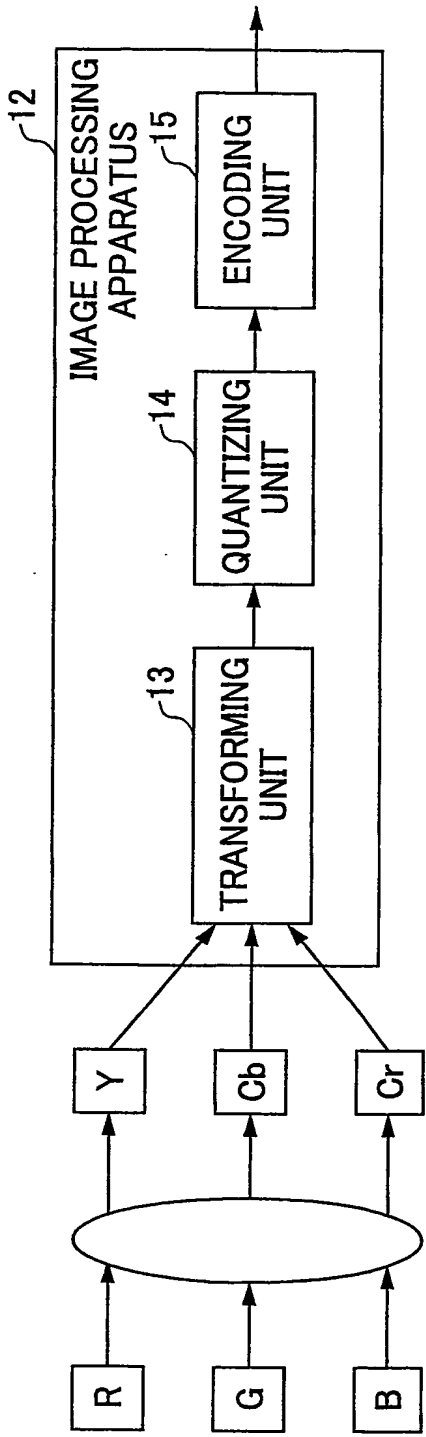


FIG. 6B

FIG. 7

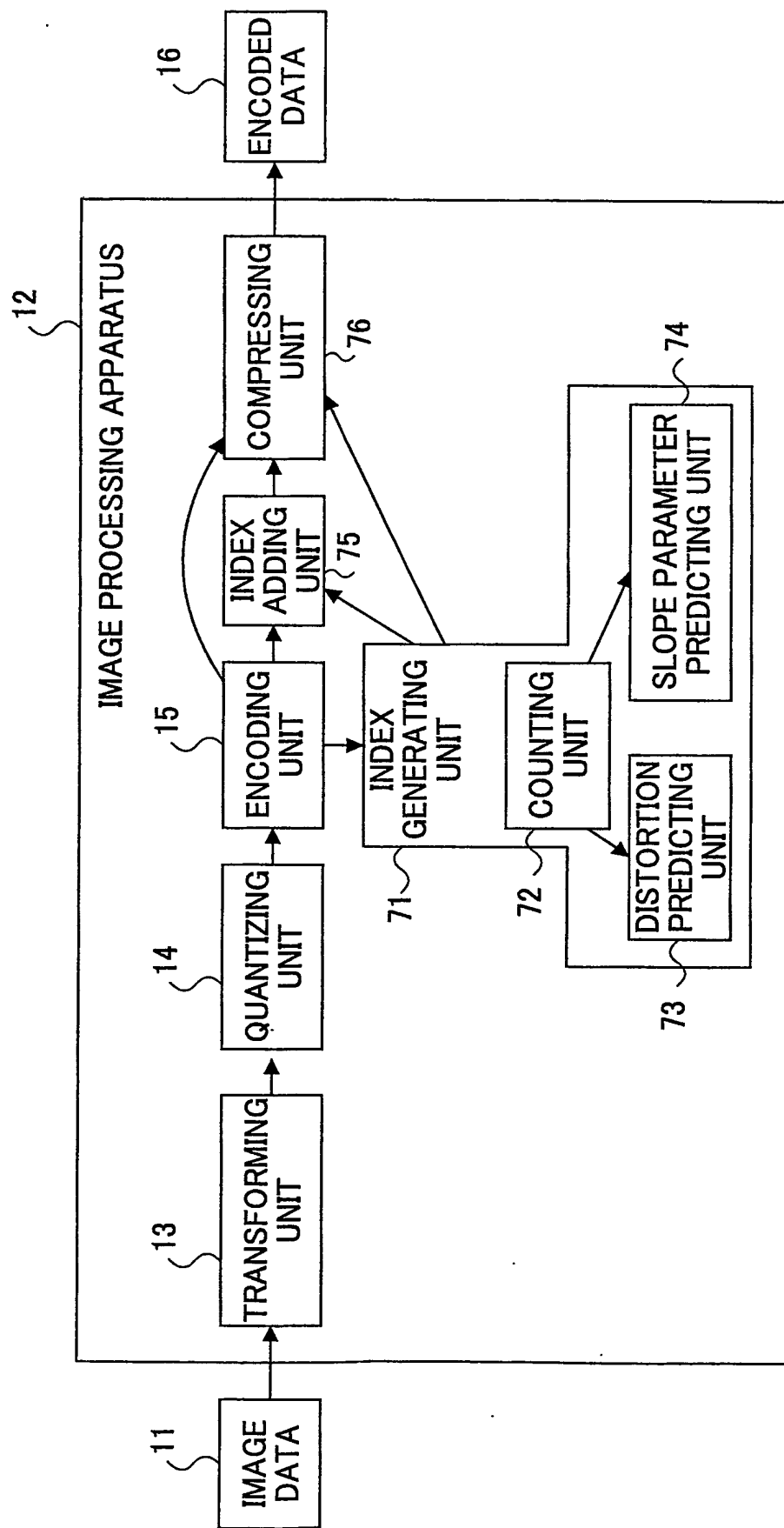
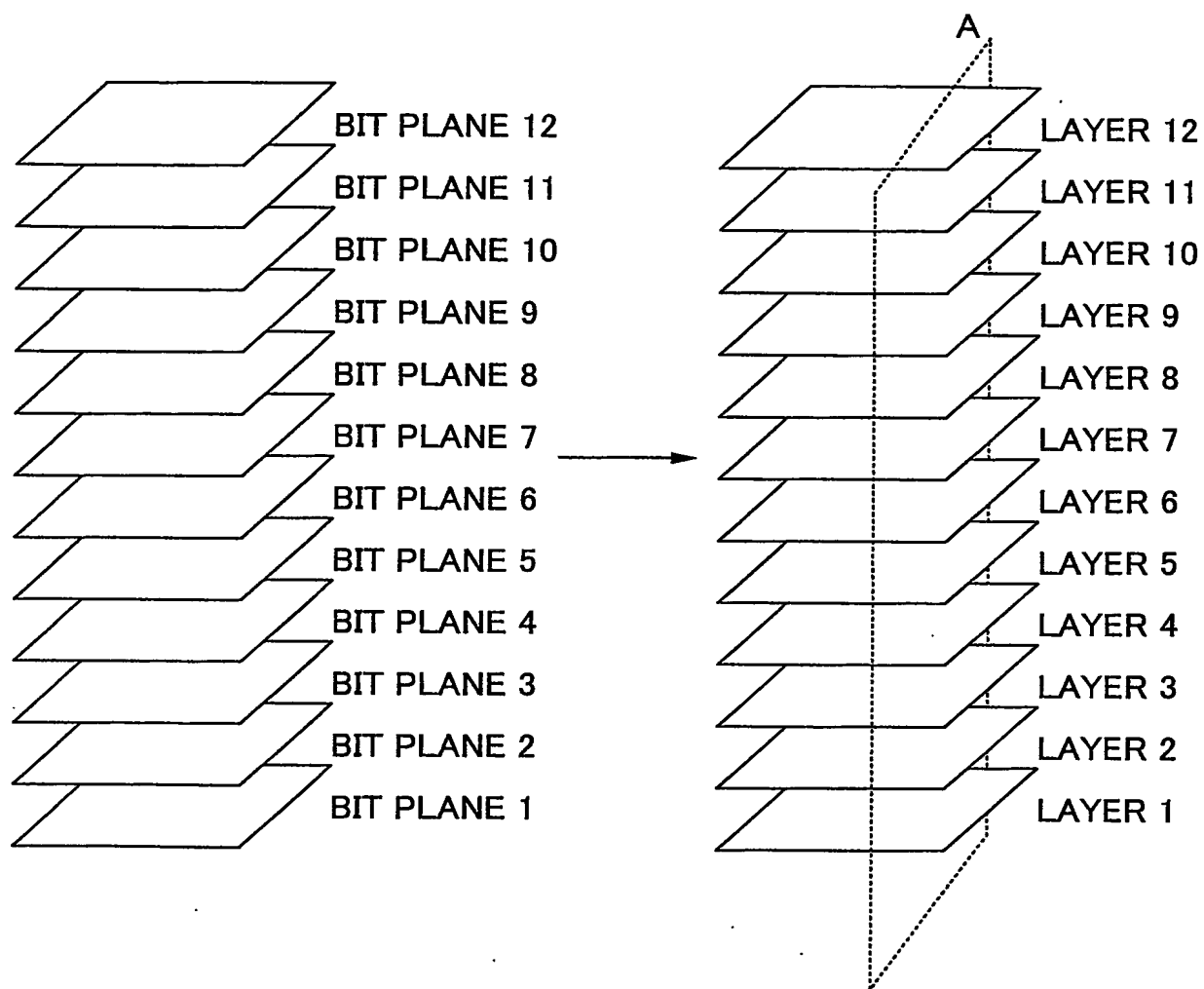


FIG.8



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FIG. 11

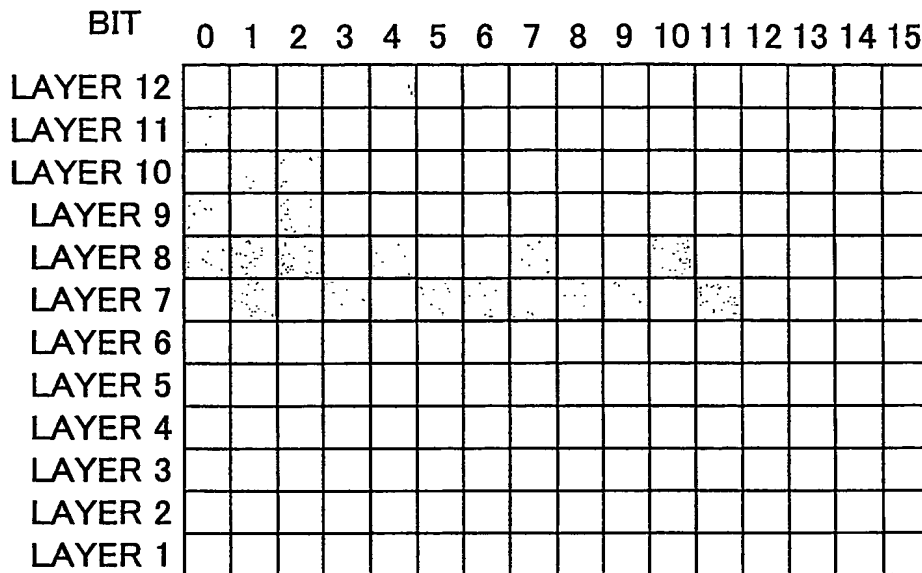
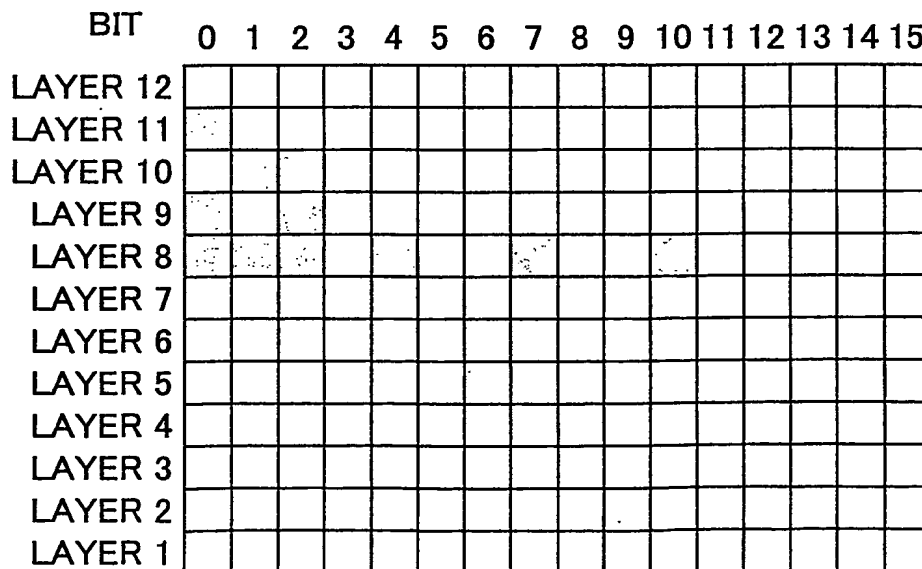


FIG. 12



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FIG.15

[illegible]

FIG. 16

[illegible]

FIG.17

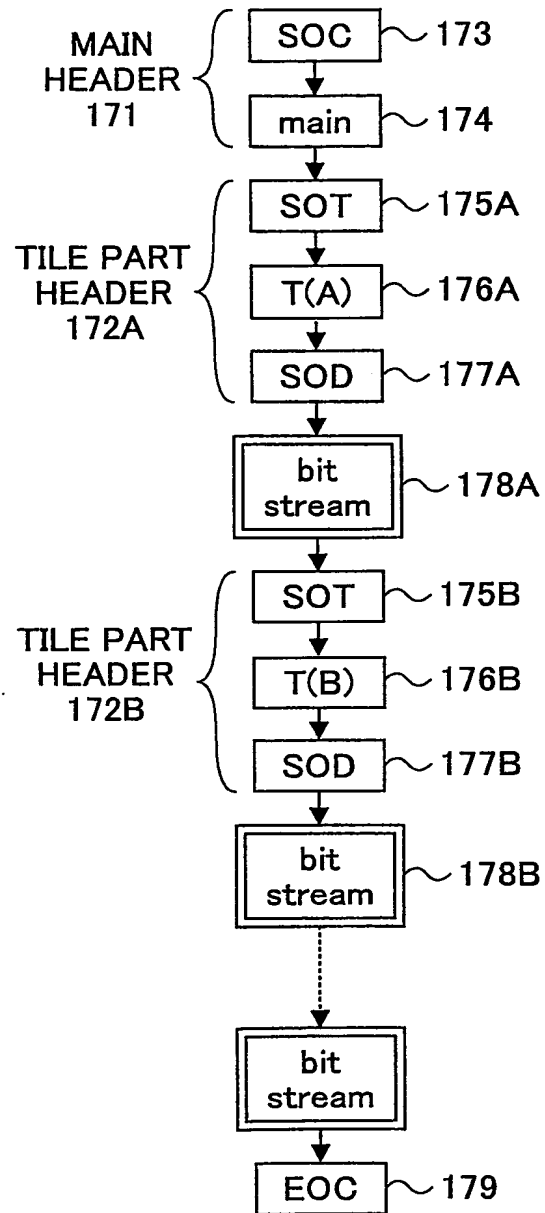
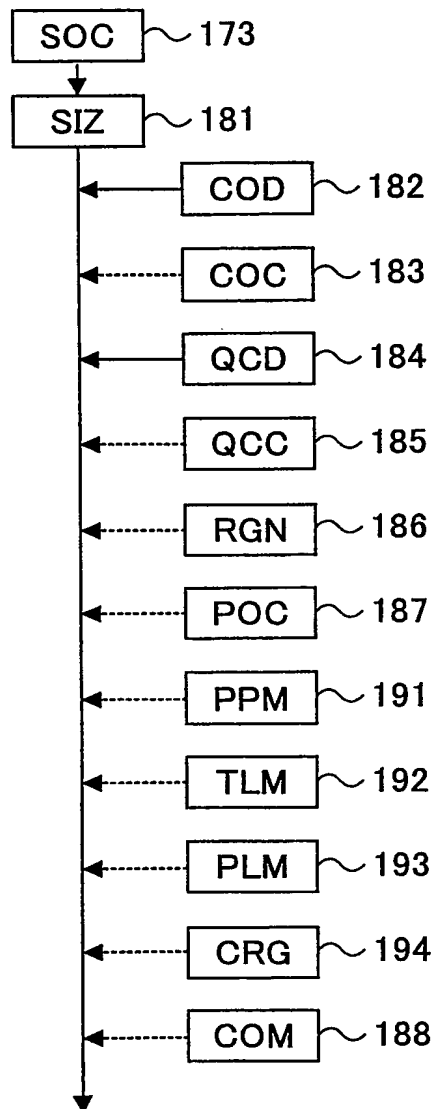
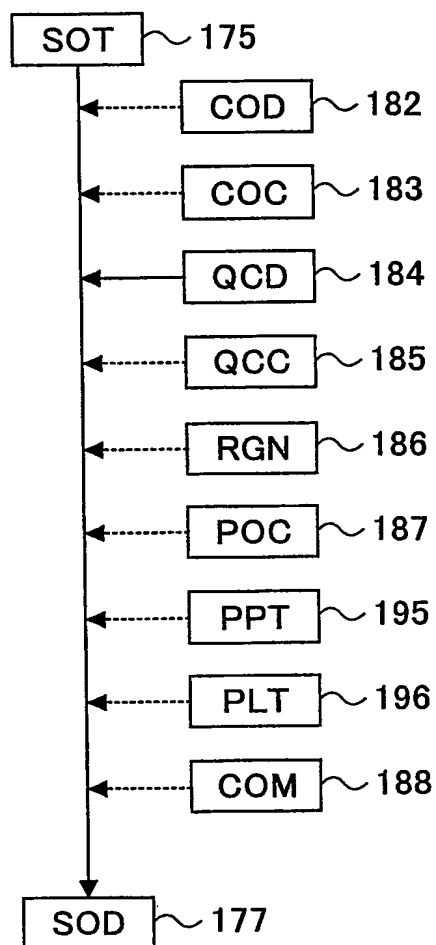


FIG.18



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FIG.19



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/05459

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl⁷ H04N1/41, G10L11/00, H04N7/30, H03M7/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl⁷ H04N1/41, G10L11/00, H04N7/30, H03M7/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 Japanese Utility Model Gazette 1926-1996, Japanese Publication of Unexamined Utility Model Applications 1971-2001, Japanese Registered Utility Model Gazette 1994-2001, Japanese Gazette Containing the Utility Model 1996-2001

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2001-320588 A (CANON INC) 2001.11.16 & US 2001/0021223 A1, & EP 1 134 968 A2 CLAIM 1, 4	1, 2, 6, 8, 11, 12, 14-20
A		3-5, 7, 9, 10, 13
X	JP 2000-188552 A (CANON INF SYST RES AUSTRALIA PTY LTD, CANON INC) 2000.07.04 & AU 005714799	1, 6, 7, 11, 14-20
A	CLAIM 1, 2, 6	2-5, 8-10, 13
X	JP 6-225153 A (FUJI XEROX CO LTD) 1994.08.12 & US 005631977 A1	1, 6, 11, 14-2 0
A	CLAIM 1, 3	2-5, 7-10, 12 , 13

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Date of the actual completion of the international search

21.05.03

Date of mailing of the international search report

03.06.03

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/05459

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 8-298555 A (CANON INC) 1996.11.12 (FAMILY: NONE) CLAIM 1,2	9,10
EA	JP 2003-101787 A (RICOH CO LTD) 2003.04.04 (FAMILY: NONE)	1-20
EA	JP 2003-101788 A (RICOH CO LTD) 2003.04.04 (FAMILY: NONE)	1-20
EA	JP 2002-185962 A (RICOH CO LTD) 2002.06.28 (FAMILY: NONE)	1-20
A	JP 9-83808 A (RICOH CO LTD) 1997.03.28 (FAMILY: NONE)	1-20

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